NATURE MAGAZINE

March, 1946 35 Cents Vol. 39, No. 3

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These recordings were all made in the birds' natural haunts. The scientists used a sensitive microphone at the focal point of a three-foot parabolic sound-reflector which was aimed, like a gun, at the singing bird. The sound waves thus intercepted were transformed by the microphone into electrical impulses, much amplified in a sound-truck, and then used to vibrate a delicate galvanometer on which was fastened a tiny mirror. A slender beam of light shining on this vibrating mirror was deflected to a 16 millimeter film which passed from one magazine to another at a constant rate of speed. Thus the bird's song was photographed so that the image or sound-track developed on the film could be used in a reverse process and made to reproduce the song, which was then, in the laboratory, recorded on a phonograph disk.

The bird's song had to be amplified several thousand times. That means that extraneous sounds, such as wind in trees, running water, airplanes, farm machinery, and notes of other birds were amplified too. For that reason many promising attempts at recording proved failures. The songs here recorded represent the best results of many efforts.

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No. 1 A	*No. 1 B*
1. Olivebacked Thrush	1. Scarlet Tanager
2. Veery	2. Rose-breasted Grosbeak
3. Wood Thrush	3. Slate-colored Junco
4. Hermit Thrush	4. Yellow-bellied Sapsucker
5. White-throated Sparrow	5. Alder Flycatcher
6. Whip-poor-will	6. Olive-sided Flycatcher

Birds of Fields and Prairies

No. 4 A	*No. 4 B*
1. Bobolink	1. Prairie Horned Lark
2. Meadowlark	2. Savannah Sparrow
3. Western Meadowlark	3. Lark Sparrow
4. Vesper Sparrow	4. Killdeer
5. Field Sparrow	5. Spotted Sandpiper
6. Red-winged Blackbird	6. Burrowing Owl

Birds of Northern Gardens and Shade Trees

No. 2 A	*No. 2 B*
1. Song Sparrow	1. Chickadee
2. Robin	2. Wood Pewee
3. Catbird	3. Chipping Sparrow
4. Baltimore Oriole	4. Red-eyed Vireo
5. Yellow Warbler	5. Yellow-throated Vireo
6. Flicker	6. Warbling Vireo

North American Game Birds

No. 5 A	*No. 5 B*
1. Ruffed Grouse	1. Gambel's Quail
2. Bob-white	2. California Quail
3. Wild Turkey	3. White-winged Dove
4. Dusky Grouse	4. Woodcock
5. Prairie Chicken	5. Canada Geese
6. Chachalaca	6. Mallard Duck

Birds of Southern Woods and Gardens

No. 3 A	*No. 3 B*
1. Indigo Bunting	1. Mockingbird
2. Pine-woods Sparrow	2. Brown Thrasher
3. Pine Warbler	3. Cardinal
4. Orchard Oriole	4. Summer Tanager
5. Yellow-breasted Chat	5. Chuck-will's-widow
6. Carolina Wren	6. Barred Owl

Birds of Western North America

No. 6 A	*No. 6 B*
1. Wren Tit	1. Lazuli Bunting
2. California Thrasher	2. Blue Grosbeak
3. Nuttall's Sparrow	3. California Shrike
4. Fox Sparrow	4. California Purple Finch
5. Western Tanager	5. Plumbeous Vireo
6. Black-headed Grosbeak	6. California Woodpecker

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Two series of field courses in Nature Study and Conservation are announced by the National Audubon Society, 1006 Fifth Avenue, New York 28, New York. Five two-week sessions will be offered at the Audubon Nature Camp near Medomak, Maine. This camp is located on a 330-acre wooded island in Muscongus Bay, and has been closed during the war years. The summer sessions will run from June 14 to August 29. The other series of courses will be given at the Audubon Nature Center, on the 423-acre tract near Greenwich, Connecticut. Four two-week sessions and one three-week session will be offered. Illustrated folders describing all courses will be sent on request.

Timber for Peace

War increased the drain on the timber resources of the country, but Lyle F. Watts, Chief of the Forest Service, U. S. Department of Agriculture, anticipates an expanded peace-time economy will create a demand for lumber nearly a third greater than even wartime requirements. In the next few years, he says, we are likely to need 21½ billion cubic feet of forest products annually, or about 5 billion more than during the war.

From 1909 to 1938, surveys indicate that forest reserves of standing timber decreased from 2,826 billion board feet to 1,764 billion board feet, says Watts.

The basic trouble, Watts emphasizes, is that commercial forest lands have not been utilized for sustained production of forest crops. "Our 462 million acres of commercial forest lands are capable of producing all the timber we are likely to use without encroaching on areas dedicated to recreational use or watershed protection. But they have not been kept productive."

Less than half the area of the public forests can be classed as commercial forest land. Public forests are kept on a sustained yield basis. "But the crux of our timber problem," says Watts, "lies in the private forest lands." He thinks public forests should be increased to include about half the commercial forest land. Land remaining in private hands should enjoy better protection from fire, insects, and disease. The educational approach alone, as a means to better use of forests, is not enough, and is too slow, he thinks. The Forest Service believes it will be necessary for the Federal government to establish standards of forests practice to stop premature cutting and keep the forest land productive. He adds, "We do not propose to regulate cutting budgets or otherwise control the volume of output, except as restrictions on forest practices may limit the amount that may be removed from any one property."

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Nature in Print

By HOWARD ZAHNISER

Along with the many trivia that clutter up my wallet until sometimes the money there is as hard to find as the car keys in the chaos of a woman's handbag, there has for years (since before the war at least) been a small piece of scratch paper with the ink-written note: "In Brazil there is a good book called 'Sertões,' written by Euclides da Cunha. In this book, he has described different parts of Brazil."

The note was penned in my old office in the Fish and Wildlife Service by Senor Armando Ribiero, a Brazilian who came from the game and fish department of the state of Bahia to observe wildlife management practices in the United States and stayed in Washington long enough to become a warm acquaintance as well as an inquiring visitor. A search at the Library of Congress unfortunately revealed that the book was not available in English, but through some chance, perhaps sentiment, the folded piece of scratch paper returned to the wallet.

A few months ago it proved to be of considerable interest to a casual acquaintance in Washington's Cosmos Club dining room—a visitor who was en route to Brazil and, to my good fortune, knew not only the book but a new translation in English. On the back of the scratch paper, glossy with some of the blackness of the leather wallet, he added with the waiter's pencil: "*Rebellion in the Backlands*, Euclides da Cunha (Os Sertões), translated by Samuel Putnam. Univ. Chicago Press." That curious piece of scratch paper is now a peculiarly precious book mark in a much prized copy of this book, which is described on its dust cover as "Brazil's Greatest Classic."

It is surprising that this work, which was originally published in Rio de Janeiro forty-four years ago, has been so long in coming to the attention of readers in the United States. It is the account of a civil war waged by an army so disturbed later by the book's revelations that the author's assassination, according to the publishers of this translation, "was said to be in retaliation for the exposures of the army in *Os Sertões* and in fear of another book." More precisely, it is the account of the same civil war as waged by a backwoods mystic and the community of backland followers to whom he was a Messiah—Antonio Conselheiro and his primitive rebels who were defeated only by the total destruction of 5200 houses and every man, woman, and child who lived in them.

Yet the book is memorable not as the account of a war but as an achievement in literature that not only gives life to men and an entire community of men, but also creates in the mind of its reader the land in which these men lived, and the fauna and flora with which they shared that land. Stefan Zweig called it "a great national epic"; Carleton Beals described it as "among the great powerful books of universal literature"; and Vincent Starrett called it "a perfect example of a work of science that is also a work of art." And even in translation, to the great credit of its translator, Samuel Putnam, it has the rounded, unhurried, deliberately fashioned, yet true eloquence of great literature. It will not be read hurriedly but it will long be read.

Euclides da Cunha (pronounced oo-kleé-des dah coón-yah), although he lived only forty-three years, wrote other books and articles—historical, biographical, or descriptive of his country—yet *Os Sertões*, which he called "this barbarous book of my youth, this monstrous poem of brutality and force," surpasses all others, and, as its translator says, "remains a towering peak of Brazilian literature." Its title (pronounced sair-toh'-ensh) means, literally, "The Backlands," but in translation has also been expanded, to *Rebellion in the Backlands*.

The first of the two parts in which da Cunha fashioned his epic is also entitled "The Backlands" (Part II is "The Rebellion"), and this first part seems invaluable—especially, for the readers of this magazine, its first chapter called "The Land," a description of the backlands of Bahia, particularly the Canudos region that includes mainly the area south of the great curve of the São Francisco River. It is a description both factual and philosophical—creative writing that can say, for example: ". . . what has to be combatted and overcome in our northern backlands is—the desert. The martyrdom of man is here reflective of a greater torture, more widespread, one embracing the general economy of Life. It arises from the age-old martyrdom of Earth." It is a description that can tell of the umbú tree dominating "the backland flora in favorable seasons as the melancholy cacti do at the time of the summer spasm."

Euclides da Cunha's description of the umbú, which he calls the "sacred tree of the backlands," may in fact represent this entire work to the readers of this magazine as well as further comment might.

"Faithful companion to the cowboy's swift, happy hours and long, bitter days, it affords," writes da Cunha, "the most apt example of the adaptation of the hinterland flora to its environment. It may be that once it grew taller and more vigorous, and that, as the result of an alternating succession of flame-belching summers and torrential winters, it has declined to its present stature and, in the course of its evolution, has undergone modifications that give it greater resistance, enabling it to defy the prolonged droughts by sustaining itself in the seasons of misery on the copious reserves of vital energy which it has stored up in its roots in more propitious times. This energy it shares with man. . . . It feeds him and assuages his thirst. It opens to him its friendly, caressing bosom, and its curved and interlacing boughs appear especially made for the fashioning of bamboo hammocks. And, when happy times arrive, it gives him fruit of an exquisite savor for the preparation of the traditional drink known as an *umbusada*. The cattle, even in times of plenty, love the acidulous juice of its leaves. It then elevates its posture, lifting the firm, rounded lines of its tuft in a perfect plane above the ground, at the height of the tallest oxen, like those ornamental plants which are commonly intrusted to the care of experienced gardeners. When plucked, these trees take on the appearance of large spherical segments. They dominate the backland flora in favorable seasons as the melancholy cacti do at the time of the summer spasm."

Although we have indeed waited a long time to read these writings in our own language, we can be grateful that its first English translation has been so well published. The volume manufactured by the University of Chicago Press (with aid from the Office of the Coordinator of Inter-American Affairs) is a highly fitting one for such a work, and it is appropriately illustrated with half a dozen picturesque pictorial drawings through the courtesy of the Instituto Brasileiro de Geografia e Estatistica. Its values, in fact, are more than those of a simple presentation of *Os Sertões*. Its four end-paper maps and its two glossaries (of botanical and zoological terms, and terms in regional use) obviate nearly all the distractions of an atlas and

dictionary, and the translator's introduction together with a preface by Afrânio Peixoto, a member of the Brazilian Academy of Letters, dispenses with the encyclopedia. It is well indexed, includes a bibliography of da Cunha, and in all is not only a volume of literature but a source book for the better understanding of a part of the Earth that is of concern to us and of increasing interest.

Rebellion in the Backlands. Translated from *Os Sertões* by Euclides da Cunha with introduction and notes by Samuel Putnam. Chicago: University of Chicago Press. 1944. 526 pp., with preface by Afrânio Peixoto, 6 pictorial text drawings, 4 end-paper maps, bibliography, glossaries of botanical and zoological terms and terms in regional use, index of names, and index of subjects. $5.

Trees of the South

Guide to Southern Trees. By Ellwood S. Harrar and J. George Harrar. New York. 1946. Whittlesey House. 712 pages. Illustrated. $4.50.

Some three hundred and fifty arborescent species indigenous to the area lying south of the Mason-Dixon line, and bounded by the Ohio River and the extension of the Missouri-Arkansas boundary to the limits of southern forests, are covered in this handy and excellent guide. The authors have made the identification text as popular as possible, and have supplied, in addition to the identification data, notes of unusual or historical interest pertaining to many of the trees described. There is also information on the economic significance of many of the trees. Thus this guide is more than a mere identification text.

Collected Poems

The Fever in the Drum. By Harry William Nelson. Groton, Connecticut. 1945. Published by the author. 30 pages. Fifty cents.

This is an interesting and varied collection of poems by Harry William Nelson. It includes a number of Nature and outdoor poems. Mr. Wilson employs a variety of poetic forms effectively.

Log Buildings

Building with Logs. By Clyde F. Fickes and W. Ellis Groben. Washington 25, D. C. 1945. Superintendent of Documents, U. S. Government Printing Office. 56 pages. Illustrated. Fifteen cents.

This is a practical bulletin on the art of log construction, from the foundation to the log furniture for the building. The authors are, respectively, engineer and architect for the U. S. Forest Service. Well-selected pictures are supplemented by detailed plans.

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Lemmon's Shield-Fern

By H. W. HIGMAN

THIS is a western fern that grows in the higher and more inhospitable places, and, certainly, Winchester Pass in the northern part of the Cascade Mountains, Washington, answers to that description. Three sharp mountain ridges meet at almost a mile above sea level to form a comparatively flat area of a few acres. Here, among the rocks, we found Lemmon's shield-fern. The conditions under which it grew seemed anything but favorable. Old snow sometimes blankets the plants until August; new snow begins in early October; gales continuously attack.

Yet the plants appear well able to face these conditions. They utilize the only possible means of protection by occupying the cavities between the rocks which, although shielding them little from the winds, probably are an effective guard against minor washouts and petty snow-slips. Their habit of growing in tufts presents the minimum exposure to the storms, and their tough, narrow fronds, with overlapping segments, further increase their resistance.

Lack of gracefulness and delicacy will prevent these ferns from being popular garden plants. But in the rugged mountains they stand stiff, staunch, and unyielding, a living part of their native rock slopes.

Pick Your Brand of Weather

By EDNA H. EVANS

As a shorthand method of representing weather conditions on the daily weather map, meteorologists have developed a code of more than 160 symbols and figures, which can be used individually or in combinations. Some of them actually resemble the phenomena they represent, but many of them look like the cattle brands used in the West in the cow country. Five is a good score, eight is excellent and ten or better indicates you either are a meteorologist or are blessed with an extraordinary imagination. This is really a difficult quiz so do not be discouraged. See page 159 for the answers.

1.		a. Snow
2.		b. Sky obscured
3.		c. Squally weather
4.		d. Dust devils
5.		e. Cumulus cloud of fine weather
6.		f. Thunderstorm
7.		g. Wind of hurricane force
8.		h. Showers
9.		i. Rain
10.		j. Storm track
11.		k. Waterspout
12.		l. Drizzle
13.		m. Unsteadily rising barometer
14.		n. Fog
15.		o. Duststorm or sandstorm

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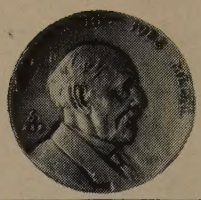

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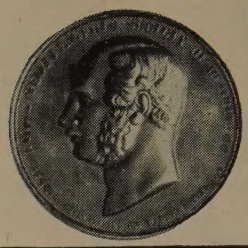

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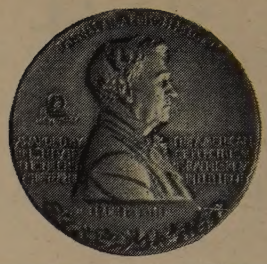

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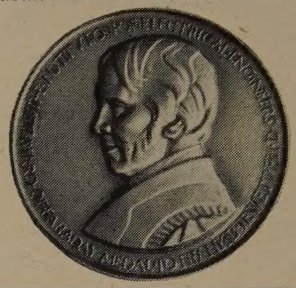
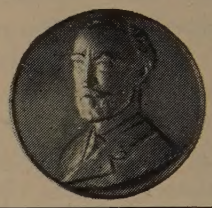


FARADAY MEDAL
INSTITUTE OF ELECTRICAL ENGINEERS

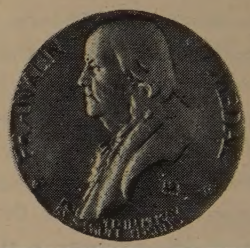


WILLARD GIBBS MEDAL
CHICAGO SECTION OF
AMERICAN CHEMICAL SOCIETY

ELLIOTT CRESSON MEDAL
FRANKLIN INSTITUTE

HENRY MARION HOWE MEDAL
AMERICAN SOCIETY FOR METALS

CHARLES B. DUDLEY MEDAL
AMERICAN SOCIETY FOR TESTING MATERIALS



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Contents Noted

EDITORS, in the opinions of many writers who offer their prose or poetry, are often regarded, we gather, as temperamental curmudgeons, unappreciative of scintillant prose and moving rhyme. If they are, no few prospective contributors interfere with the orderly operation of the editorial gastric juices by the ways in which they peddle their wares. We could cite a number of things, but will content ourselves with a word for the writer who sends in prose or poetry with the typed page unsullied by any return address; now and then without even a by-line. After fishing in the waste basket, we often discover that the return address is even left off the envelope that brought the undying literary work to the editor's desk. There is nothing to do but set such offerings aside and await an indignant letter demanding action. In this connection, will Floyd A. Swink let us know where he lives, and will the author of the poems, "When a Cardinal Sings" and "To a Mouse," reveal his identity and whereabouts. Our secretary has some other unmailable offerings of which she would like to rid her files.

FREQUENT protestation comes from those engaged in predatory animal and rodent control work of the Federal and State governments that this activity is designed only to keep the numbers of such animals within bounds. Never—oh, never!—is the extermination of any species sought. This does not seem to square with the chagrin expressed by the Fish and Wildlife Service upon the discovery of a thriving ten-acre colony of black-tailed prairie dogs in Cochise County, Arizona. The Service says that this species was "thought to have been exterminated in Arizona more than twenty years ago," and apologetically observes that this colony was probably formed by "the offspring of a few rodents which survived early eradication campaigns." The words "extermination" and "eradication" are not synonymous with the word "control," at least not in our dictionary.

VERMONT is far in the lead among the States prepared to give a proper welcome to tourist-visitors in the postwar years. It will be a *proper* welcome because the Green Mountain State is currently ridding the environs of its highways and its rural countryside of billboards. This achievement is an example of public sentiment at work in the democratic manner. A restrictive state law was passed, against which the billboard industry fought in legislature and court without success. Then came a procession of communities, which, in Vermont, include much of the surrounding countryside. They voted out the billboard through zoning ordinances. So the billboards are coming down, and no more are going up, and visitors to the State will find that the beauties Vermont advertises in the newspapers and magazines are really there and not marred by landscape parasites.

PENNSYLVANIA is one of the few remaining States where there is great enthusiasm for the bounty system as a means of controlling so-called predatory animals. Among those on the quite long list of birds and mammals, which Nature made predatory in her plan for balance, are the gray and red foxes. These bring a bounty of four dollars for each animal. Some of the State Game Protectors in the field are not as enthusiastic about this system, however, and the comment of one is worth recording as showing one effect of bounties. He says: "The bounty plus the publicity given the predator control campaign has produced more trappers than I thought possible. Every person who ever set a trap and a lot who never did became would-be fox trappers. Consequently our section is full of crippled 'coons, skunks and rabbits. Of course several foxes were taken, but what are left are well educated. . . . Personally, I don't think the results were worth the cost.." We do not believe that payment of bounties is ever worth the cost, not only in money but in destruction of other forms of wildlife caught in traps set to catch the proscribed animals.

ESTABLISHMENT of community forests as a memorial to soldiers, sailors and marines who gave their lives in battle is an idea gaining wide favor. Foresters, both Federal and State, are receiving many inquiries as to how to go about setting aside and administering such an area. There are questions about what trees to plant, if planting is necessary, and about laws governing the creation of such areas. The volume of such inquiry has been so great as to indicate just about all the questions that can arise. Hence the U. S. Forest Service has prepared a complete list of suggestions for the establishment and maintenance of community or memorial forests. This is available free from the Forest Service, U. S. Department of Agriculture, Washington 25, D. C. R. W. W.

Hawk-Wings

By DANIEL SMYTHE

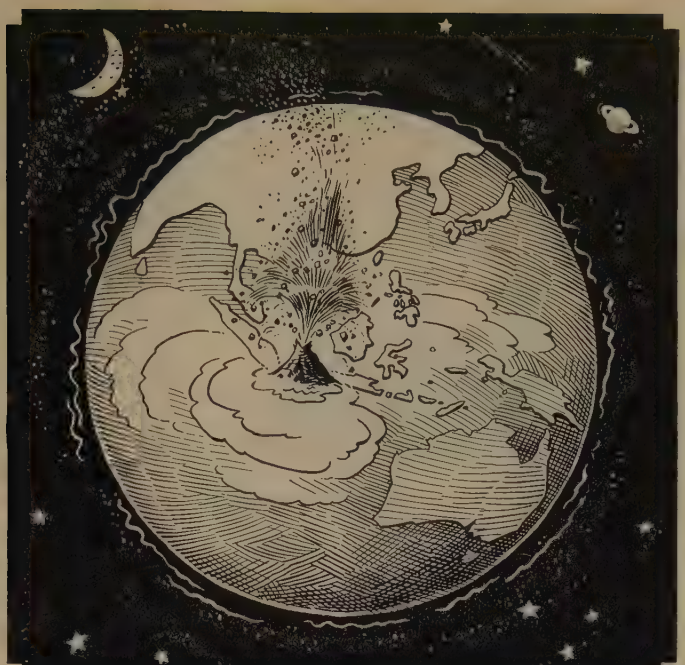
Beyond careening patches of the light
That wrinkle on the mountains far below,
I see the hawk-wings, moveless in their flight,
Speeding a bit of shadow to and fro.

So huge they are—so silent, yet so swift,
The tallest summits ebb and fall away
When these thin wings cross slips of light and drift
Against the backdrop of the fading day.

The forests rush upon the tents of dark
That fall along the thick and silent deep;
But this, a picture I have paused to mark,
Is with me as I turn to bed and sleep . . .

Frail feathers coasting up long tides of air,
Beating the shade that scales the peaks of earth—
A courage vaunting what it is to dare,
A silent wing upon the mountains' girth.

MARSH HAWK PHOTOGRAPHED BY ENOCH REINDAHL



When Krakatoa blew up the whole world knew about it. Air waves and dust circled the earth.

Earth's Most Awful Blast

By ERNST BEHRENDT

Illustrated by Garnet Jex

THE WORLD is awed by the might of the blasts that devastated Hiroshima and Nagasaki, but there was once an explosion that was incomparably greater. Those atomic bombs flattened two cities, yet people a few dozen miles away were oblivious of the fact. All was over instantly, and almost instantly survivors began clearing up the rubble. The surrounding landscape looks as it did before.

But when Krakatoa blew up, on August 27, 1883, the whole world knew about it. The sound waves were noted 3000 miles away. People hundreds of miles away were killed. The great waves the explosion caused in the sea reached the shores of four continents, and were recorded 8000 miles away. An air wave generated by the blast traveled clear around the world, not once but several times. And where had been a mountain half a mile high was now a hole a thousand feet deep and miles across. There was nobody left to clear away the rubble on Krakatoa. In fact, there was not much left of Krakatoa itself.

The ground grew hot under foot.

Red-hot debris covered an area the size of Texas, to a depth of sometimes 100 feet on land, and raising new islands where the rain of rock built up the bed of the ocean. For almost a year afterward the dust of the explosion, blown upward for 30 miles, filled the high atmosphere over the whole globe. Even though there were no large towns within 100 miles of the volcano, 36,000 persons lost their lives.

The biggest blast in history was not caused by atomic fission; no staff of scientists was needed to set it off. It was caused by nothing more mysterious than the old-fashioned force that rattles the lid on a teakettle. But the fire under the kettle was a mile-long pocket of seething lava and it changed a cubic mile of ocean into superheated steam. The lid blew off and the kettle exploded as well.

Krakatoa was an island of about 18 square miles in the Sunda Strait, in the Dutch East Indies, between Java and Sumatra.

Early in the spring of 1883, there were warning signs. Smoke and steam poured from recent fissures in the rock. A river of lava cut a wide swath through the tangled jungle. But the Dutch in Batavia and Palembang and other places on Java and Sumatra were not alarmed. There had always been some volcanic activity in the Sunda Strait. As to the natives' tales of the big explosion that in olden times had split the earth and destroyed the world, why should anybody take them seriously? It was ascertained later that those tales were based on reality. A gigantic ex-

The gods on the island of Bali trembled on their stone pedestals.

plosion about 200 years before had scooped out an enormous crater and from its rim formed the islands of the Krakatoa group. The old volcano seemed all but dead and its faint rumblings could alarm nobody but superstitious Malays.

Even when the Dutch captain Ferzenaar arrived in Batavia with a report of two new volcanoes which had appeared on Krakatoa, the Dutch were not impressed. Two new volcanoes—why, there were scores of volcanoes in Indonesia, many of them active, and it could hardly matter if there were two more; besides, Krakatoa was almost a hundred miles away.

"The ground was so hot it burned right through the soles of my boots," Captain Ferzenaar had said. Well, if it was that warm on Krakatoa the few natives who lived there would have to take to their boats and wait until the island cooled off.

Meanwhile the old mountain was gathering its strength. It had two allies now, the two new volcanoes that Ferzenaar had seen and which the natives called Danan and Perboewatan. They had appeared half a dozen years before—not volcanoes at first, but geysers spitting jets of white steam in the shallow inland sea of Krakatoa. Cones of mud had formed around the geysers, then solid land, and they had started to move toward Krakatoa itself, one pressing from the center of the inland sea, the other from the north. Danan and Perboewatan kept growing larger, and kept moving. From time to time they hurled pumice and blocks of obsidian into the air; then they moved on, relentlessly, and finally merged their masses with the island. But even then their movement did not stop; they pushed on, their enormous weight upsetting the foundations of the island and compressing the fiery lava pocket underneath.

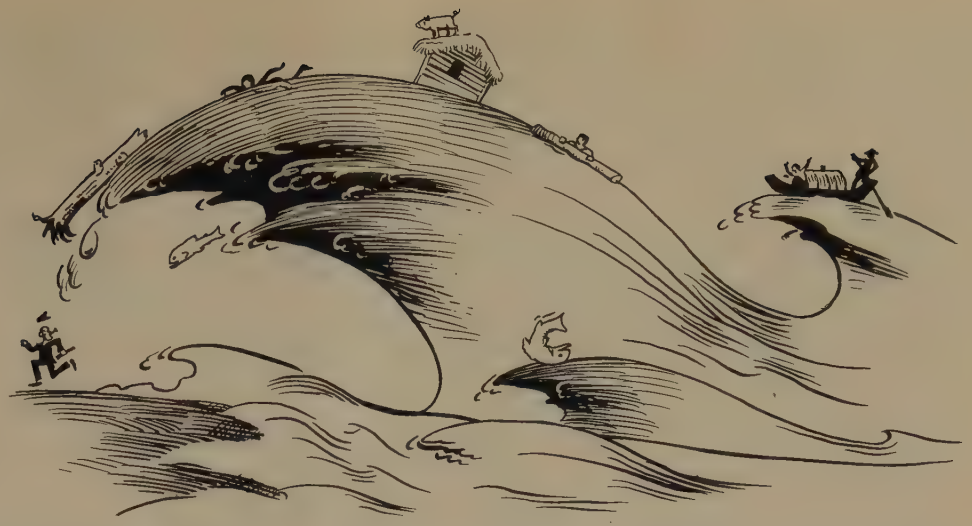
Captain Ferzenaar had visited the island on August 11, 1883; he was the last white man to set foot on Krakatoa before the eruption. The heat which had burned through the soles of his boots was now making life unbearable for the natives. They packed their belongings and set out in their proas for Seseby and Pulau Panaitan and other islands in the Sunda Strait, or for the near-by coasts of Sumatra and Java.

Krakatoa was making navigation difficult. Several captains turned back when they saw the narrows covered with a foot-thick layer of cinders; ploughing through them was like sailing through an evil-smelling swamp. Other skippers braved the heat and the volcanic bombs, which plunged into the ocean and sent up columns of steam. Among them was the captain of an American freighter who battened down the hatches and calmly sailed through the hissing sea. His cargo—kerosene!

No one after him attempted the passage. By now even the Dutch in Batavia realized that this was not just the usual kind of thing. Krakatoa's rumblings had grown into a continuous, angry roar heard along the entire east coast of Java. In Buitenzorg, 61 miles from Krakatoa, people were seeking shelter from what they thought was a gathering thunderstorm.

"In the afternoon of August 26," R. D. M. Verbeek wrote in his description of the catastrophe, "the low rumbling was interrupted by sharp, reverberating detonations. They grew louder and more frequent. People were terrified. Night came, but no one thought of sleeping. Toward morning the incessant noise was drowning out every other sound. Suddenly, shortly before seven, there

Natives packed their belongings and set out in their proas for islands in the Sunda Strait, or for the nearby coasts of Sumatra and Java.



A retired sea captain was looking at the fantastic spectacle in the skies when suddenly he noticed a new island in the strait. The next moment he was running for his life.

was a tremendous explosion. Buildings shook, walls cracked, street lamps fell down, plaster rained from the ceilings, and doors flew open as if pushed by invisible hands. Everybody rushed into the streets. Another deafening explosion, and then everything was quiet as if the volcano had ceased to exist."

The volcano *had* ceased to exist. Under the combined weight of Krakatoa, Danan and Perboewatan, the subterranean pocket of white hot lava had been building up an enormous pressure. Seething with the expansion of its gases, it found temporary outlets in the two craters, which normally acted as safety valves. But, as the weight on the lava increased, the craters became too small to control the pressure. Unimaginable energies were straining against hundreds of feet of solid rock overhead. The rock heaved, buckled; suddenly it cracked wide open like the wall of a defective cauldron.

With all the fury of a primordial cataclysm a stream of lava burst forth in a deafening roar. Seconds later the ocean rushed into the opening. On contact with the white-hot lava the water changed into superheated steam. The opening widened; colossal blocks of granite and obsidian rocketed upward amidst a cloud of dust and smoke. Again the ocean rushed in, battling the pent-up lava, changing into expanding, exploding superheated steam, breaking down barrier after barrier of rock, smashing the walls of the cauldron from the inside and tearing the bowels of Krakatoa to shreds.

No one knows how many times this happened, how often the white-hot magma pushed back the ocean and how often the ocean returned to the assault. In the end the water won. Early in the morning of August 27 the ocean reached the volcanic center of the island and attacked the molten cores of Danan and Perboewatan. Even the fury of the previous explosions was but a faint prelude to the final cataclysm as the heart was ripped out of Krakatoa and 14 cubic miles of rock streaked upward straight into the sky.

The sun was blotted out behind a curtain of ebony torn by jagged lightning. Miles away, Krakatoa's pyrotechnics awed the sailors of the English ship *Charles Bal*, who saw the island shoot up over the horizon, "shaped like a pine tree brilliantly illuminated by electric flashes." Suddenly the sea was covered with innumerable fish, poisoned and cooked, floating belly-up on the churning water. A sailor dropped the lead and brought it up—hot.

Long afterward came the noise—the loudest ever heard by human ears. "The concussions were deafening," wrote Lloyd's agent in Batavia, almost a hundred miles away. They hammered every eardrum in Java and Sumatra, alarmed the Dutch officials on Celebes and Flores, and put fear into the hearts of Borneo's headhunters. They reached Timor, Halmahera and the Philippine Islands, and Victoria Plains in Australia, 1700 miles away. The sound waves struck Daly Waters in South Australia, 2023 miles from Krakatoa, and traveled 2968 miles in the opposite direction to Rodriguez Island near Madagascar.

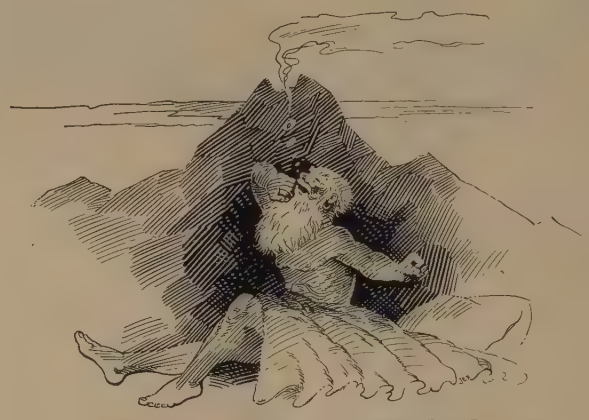
When he regained consciousness he was sitting on the top of a tree half a mile inland.

With the noise, concentric waves of air started on their way around the globe. A day and a half after the explosion, the first of them hit London from the west. Then a second wave rushed over the city from the east. Four times the east-bound wave swept over London—and over Berlin, Palermo, St. Petersburg and Valencia as well—and three times it swept back. The stratospheric seesaw continued for more than ten days before the blast had spent its force.

Far more violent was the effect of the eruption on the sea. In Anjer, on the east coast of Java, a retired sea captain was looking at the fantastic spectacle in the skies when suddenly he noticed a new island

which had bobbed up in the strait. The next moment he was running for his life. The island was a wall of water, 50 feet high, advancing across the narrows at incredible speed, battering down the wharves, engulfing Anjer, racing uphill, a dark, roaring, compact mass of rocks and trees and houses smashing everything in its path. The wave flung a log at him, and he went down. When he regained consciousness he was sitting on the top of a tree half a mile inland, stripped of every shred of clothing but otherwise unharmed.

He was one of the few who saw the wave and lived to describe its fury. Anjer had vanished. It had been swept away by the same wave which, rising to a height of a hundred feet, overran the towns of Karang, Merak and Tji-ringen. The wave wiped out scores of villages and killed tens of thousands of people. Even before it struck, a rain of rock and pumice had fallen on the low-lying islands in the Sunda Strait; incandescent ashes had covered the huts and forests with a layer more than a hundred feet thick and extended the shore lines far into the ocean. So much was the sea filled up that half a dozen new islands rose above its level. But now a colossal cataract roared over the new land and washed it away, cinders, villages, jungles and all.



The old volcano was not dead.

In the harbors the wave pounded ships to pieces or picked them up and whirled them ashore on its lofty crest. On the coast of Sumatra, the wave tore the warship *Beroun* from her moorings and drove her, anchor dragging, two miles inland, leaving her stranded in the middle of a jungle 30 feet above sea level.

Farther out the wave smashed steamboats, proas, sampans and junks. It raced across the entire width of the Indian Ocean, played havoc with the shore installations of Ceylon, swept on, skirting Madagascar, and when it reached Cape Town, 5100 miles away, it was still a foot and a half high. It rounded the Cape of Good Hope, turned northward into the Atlantic, along the coast of Africa, and at last disappeared among other waves near the British Channel.

Ashes had fallen on Indonesia like snowflakes in a blizzard. Whole districts were buried, their jungles choked, their rice paddies changed into deserts. The sky was so filled with ashes that for a time lamps were needed all day in Batavia.

But what covered the land and the sea was only a small part of the volcano. Most of Krakatoa's solid rock had been pulverized, and blasted to a height of 150,000 feet. Clouds of volcanic dust hung suspended in the stratosphere for months. Air currents picked them up and carried them across oceans and continents. In Europe and Australia, all over the world, the rays of the sun were filtered through a veil spun in the depths of Sunda Strait. Paris, New York, Cairo and London recorded a long series of the most glorious sunsets; the sun appeared blue, leaden, green and copper-colored, and at night the earth was steeped in the light of a green moon. Even the stars shone with an eerie green light.

The phenomenon lasted into the spring of 1884; then the colors faded, and Krakatoa's magnificent shroud disappeared. The final chapter in its history seemed to be over. Krakatoa was dead, utterly dead. Nothing was left of it but a few square miles of rock buried under a mountain of ashes. A submarine abyss yawned where men and beasts had breathed.

All plants and insects and birds and mammals had been dissolved in a fiery cloud on August 27, 1883. Two months after the eruption Verbeek visited Krakatoa and found no trace of life on the island, "where the ejected matter was so hot that the coolies danced on their bare feet." Then a miracle happened—the miracle of the rebirth of life. Four months after the eruption, a botanist found no plant life, but did find something alive—an almost microscopic spider, gallantly spinning its web where there was nothing to be caught.

Much later, naturalists speculated on whether life of some kind might have survived in deep rock fissures—seeds, spores, worms, insect eggs, perhaps even snails and lizards—but there is no evidence that they did. That pioneering spider, it was concluded, drifted in on the wind.

For years to come the evidences of life on Krakatoa could have been counted on the fingers of one hand. One spider in 1883. Three blades of grass in 1884. Nothing in 1885. Nothing in 1886. A few shoots of grass in 1887.

And then they came, the grasses, mosses, ferns and shrubs, the worms, ants, snakes and birds, in swelling streams which converged on the island. In a few decades they restored the teeming life of the tropics. They arrived by air—seeds dropped by birds on their flight over the barren land; spores, small caterpillars and ants carried by the wind; beetles, mosquitoes and butterflies winging their way over from Java and Sumatra. They arrived by water—eggs of worms and reptiles flung ashore with flotsam; snails, scorpions and praying mantises riding the waves on decayed tree trunks; large monitor lizards, pythons and crocodiles swimming (Continued on page 160)

PHOTOGRAPH BY WILLIAMS

This photograph of massed albatrosses was taken on Laysan Island during the eighteen-eighties, and provides a graphic picture of the splendid isolation in which the birds nested and raised their young. There is not much room for construction of an airstrip, however.

The War and Pacific Birds

By GEORGE C. MUNRO

NOW THAT the guns are stilled and men fly on missions of peace, the question arises as to what war did to the birds of sea, land and air in the Pacific. Much of the havoc of war is indirect, and only a careful study can measure its total effect. However, on the basis of certain facts, plus experience and conjecture, we can arrive at some conclusions. These are both interesting and important.

From time immemorial most of the central Pacific islands have been nesting places for myriad sea birds. Guided by hereditary impulses, these birds returned, year after year, to the island of their original nest. There was virtually no month in the year in which birds of some species were not on these islands. These birds were threatened, in 1939, when naval bases were established on a number of low-lying coral islands. Then came war itself, with the necessity for speed and extensive development that could reckon with nothing save the goal of victory. Such activity could not be reconciled with the normal routine of great colonies of birds carrying on their life cycles in vast isolation.

Into this peaceful avian picture came man and his machines. It could not mean much to him that the Bonin petrel arrives on some islands in late August, and that some of its young are still there in mid-June. Building of an airstrip could have no concern with the fact that two species of albatrosses nest on certain islands near the end of October, and that their last young do not depart until July of the fol-

PHOTOGRAPH BY LEWIS WAYNE WALKER

A colony of sooty terns, which nest on the surface. The birds would move out of the way of bulldozer or tractor, but their eggs or young would be crushed, accounting for the loss of many birds, a situation that was as unfortunate as it was unavoidable.

lowing year. The wedge-tailed shearwater arrives about the end of March and stays until near the end of November. The Christmas shearwater is bringing out its chicks in the middle of June, when the wedgetails are just laying their eggs.

The albatrosses, Christmas shearwaters and Bulwer's petrels lay their eggs on level areas of ground. The Bonins and wedgetails dig burrows for their eggs, each species at a different level of ground. Terns, boobies and tropic birds come at different times during the summer and nest on the surface. Thus it was a sort of continuous performance, and there was no time in the year when construction could be carried on without danger to the birds.

The albatrosses refused to move from their nests in the face of tractors and bulldozers. Other birds, unseen in their burrows, were crushed to death, probably in great numbers. Terns, boobies and tropic birds would move out of the way, but some would be killed, as would their young.

All this was as unfortunate as it was unavoidable. Yet, the Navy was concerned about the situation, and I was among those called upon for advice. There was no easy solution. In fact, I thought it unsafe for airplanes to have large birds near the landing strips. A bird drives through the air at high speed when coming in to land on treeless islands, and I judged they would be a menace to the safety of pilots.

That birds, however, are adaptable creatures was proved when I visited Midway in June, 1945. I found that they had learned to modify their speed, and in other ways to adapt themselves to changed conditions. I was astonished to see hundreds of full-grown young albatrosses sitting in masses along the borders of airstrips and among barbed-wire entanglements. They were so thick on the ground that it was plain not many adults could have been killed by man-made obstructions during the seven months since the birds had arrived on the island.

Construction was not the only danger to the birds. The din they made at night taxed the tempers of civilian workers and servicemen. When the sooty terns arrive at nesting time they do not immediately alight on the island. For a time the flocks come in after dark and leave before daybreak, filling the night hours with screaming while on the wing. When they finally land, there is an incessant night din because some birds are always aloft and screaming. Even the tired man finds sleep difficult.

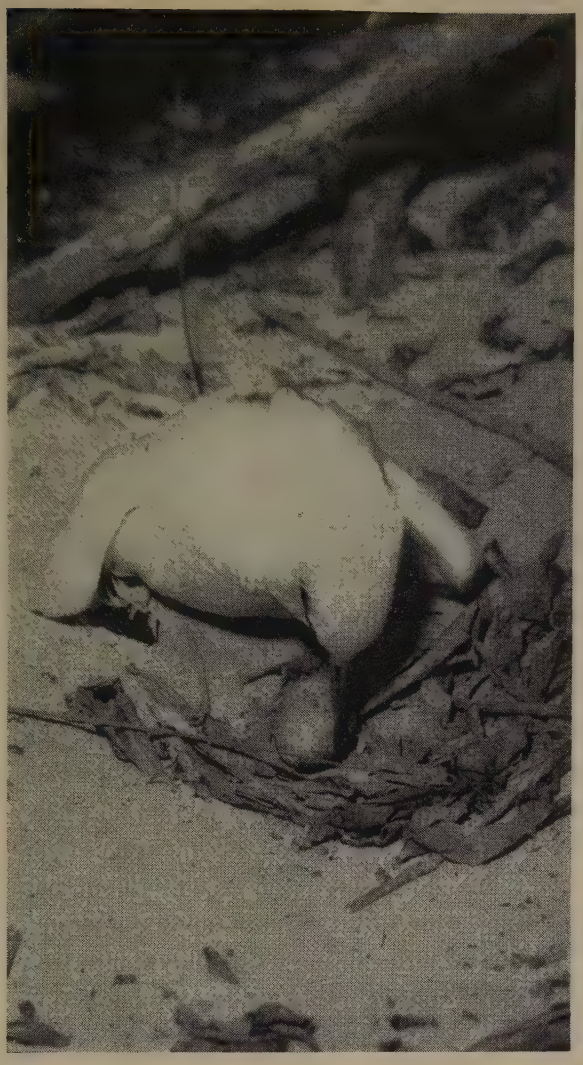
The shearwaters and petrels all have different degrees of mournful and wailing cries, varying in intensity throughout the night. Their burrows are often made near sleeping quarters, and their dismal voices banish sleep, often resulting in war on the birds. One man told me that he had slept in a dugout. A bird dug its burrow beside a ventilator pipe to the room. When its song became unbearable he would go out and drive the bird away, but, as soon as he was comfortably in bed again, it would begin afresh. When a flashlight is suddenly turned on the birds are dazzled and many birds were thus destroyed.

Some birds, of course, come to grief striking trees, overhead wires, planes and buildings, but such fatalities are fewer than would be supposed, considering their original flat, treeless island nesting places. An officer recently returned from Midway has assured me that few albatrosses are killed by the planes. The shearwaters and petrels on the more populated islands may still be condemned when they undermine concrete paths and the underpinnings of buildings.

A threat to smaller birds on some islands are rats that have found their way ashore because of wharves being built and from modern war landing craft that run right up on the beaches. On islands where ships

have to lie off, and all landing is done by small boats, rats do not readily get ashore. Rats have only recently gained access to Midway but have exterminated two imported land birds on the island and reduced wild house canaries from five hundred to thirty. It is likely that the Laysan rail is thus entirely exterminated. If the rats had not been effectively combated they would have greatly reduced the numbers of some small sea birds, notably the lovely little white tern and gentle Bulwer's petrel.

However, after the killing of such large numbers of birds a recent estimate by two expert bird counters gave albatrosses on the two islands of Midway as 135,000; wedge-tailed shearwaters, 60,000; Bonin Island petrels, 25,000; red-tailed tropic birds, 19,000; white terns, 20,000; sooty terns, 170,000. Since it is difficult to take counts of some sea birds, especially burrowing birds, these counts may be low for some species.



A red-tailed tropic bird inspects its egg. This bird was described by Lewis Wayne Walker, who took this picture, in the December issue of Nature Magazine.

Now that the war is over there will be a tendency to look for someone to blame for damage done. The Navy will probably be pointed to as particularly responsible for destruction of birds on oceanic islands. My experience with Navy personnel, dating even from before the war, has been a most pleasant one. Officers of all ranks have shown a solicitude for the birds. From Admiral Nimitz down, they have apparently observed and been interested in the avian residents of the islands. They have done their best to refrain from using sanctuary areas for war purposes, and, with the war ended, have turned their attention to restoration of bird life.

Admiral Nimitz, in his numerous visits to forward bases, kept in mind the welfare of the birds amid all the problems of war. When it was discovered what rats were doing to birds on Midway, an intensive rat campaign was inaugurated by Commodore Gail Morgan, then commander of the base. If such concern is shown in the future, I feel optimistic about the fate of the birds.

When birds are in such large numbers as the recent count on Midway indicates, and since other islands of the Hawaiian Chain have been little disturbed by the war, we can be sure that the birds will make a rapid increase if adequately protected. Animals breeding from a small number make slow progress. But when numbers are large, even with birds that lay but one egg in the year, the increase is large. Then there is a logical saturation point, when no further increase can be made and the balance of Nature becomes established. I have been told by an observer on one oceanic island that when the frigate birds become too numerous the boobies, which provide most of its food, leave the island for a season and the frigates die in large numbers. I once saw a slope covered with skeletons of frigate birds that had died on the ground, perhaps for this reason.

It is not the mere presence of human beings, or the noises of their activities, that injure the birds. It is the company they bring with them. Dogs, cats, rats, other predaceous animals and introduced diseases are largely responsible for reducing the numbers of native birds. Island life is also more readily affected by disadvantages of this kind than larger areas of land. The birds soon become accustomed to the presence of human beings. In fact, they do not fear them at all until given cause to do so. In August, 1943, I was on the island of Mokumanu—three-quarters of a mile from the coast of Oahu—where there is one of the largest air bases in Hawaii. Birds were in immense numbers on the island. They were quite oblivious to the airplanes overhead and heavy practice gunfire ashore, three-quarters of a mile away. This base was established before the war, and the nine species of birds that nest there have suffered no apparent damage, thanks to the care exercised by the Navy. Again, in October, 1945, I banded a few birds on a tiny island that was not considered a bird sanctuary before the war. It had no shearwaters breeding on it when I visited it in 1938. The island had been used as a bombing target. A colony of young shearwaters, probably up to fifty, occupied burrows on the side opposite from the bombed area. (Continued on page 160)

Oil–The Power of Modern Man

By GERRIE GEHR MILLER

A TOURONTON is an Indian word that means "Oh how much there is of it!" and was their descriptive term for oil. Indians skimmed it off rivers and used it for greasing aching muscles, for war paint, and sometimes to burn. Occasionally a river, like the Ohio, would catch fire from the dull, brownish-black scum, and burn for hundreds of miles, destroying nearby vegetation and forcing the Red Man to flee.

George Washington knew about *atouronton.* He owned a "burning spring," but apparently made no use of it. Lemuel Stockton, a farmer liv-

Below, a street scene in Oil Creek, Pennsylvania, in 1871, showing petroleum being transported by a wide variety of means of transportation. In contrast are the long lines of tank trucks shuttling fuel for the oil-hungry tanks of Superfortresses on Saipan. On a single mission to Japan one of these great planes burned enough gasoline to run a family car for 120,400 miles.

PHOTO FROM THE BETTMANN ARCHIVE

PHOTO FROM THE BETTMANN ARCHIVE

A study in contrasts. At the left, the three catalytic crackers of the Baton Rouge, Louisiana, refinery of the Standard Oil Company of New Jersey. Above, an oil refinery of an early day, the workmen turning out lubricants and oil for homes.

ing in Cumberland County, Kentucky, drilled for a salt well in 1829 and brought in an oil gusher. He was so disgusted by his failure that he allowed the stuff to flow into the Cumberland River, thus causing a fire on the river that spread 100 miles, to Gallatin, Tennessee.

It was not until 1859 that anybody deliberately set out to drill for *atouronton*—known by then as "rock oil", and on August 27 of that year Colonel Edwin L. Drake brought in the first oil well on the banks of Oil Creek, near Titusville, Pennsylvania.

But, even then, there was not much demand for oil. Drake, and the others who flocked to the site to duplicate his achievement, were interested chiefly in something with which to grease axles and to burn in household lamps. Crude efforts to refine the oil were made, but the axle grease remained too thin, and the kerosene kept exploding.

The explosive nature of kerosene was caused by an objectionable element called gasoline. The scientists of those days could think of no way to eliminate this gasoline excepting to sluice it off into dumps.

The first elemental products of *atouronton*—which we now call crude oil, or petroleum—had a difficult time catching on. Today its products provide power for almost all engines, and it made World War II a speedy, deadly interval in civilization's progress. Petroleum's 500-odd products provided many things, from the motive power for the warships of the United Nations, to wrappings for the rations of the men on the battle fronts. More than 294,000,000 gallons were produced and used every single day by the United Nations.

George Washington, when he and General Andrew Lewis received a patent on the tract of land near the present city of Charleston, West Virginia, wrote that he took up the section "on account of a bituminous spring of so inflammable a nature as to burn so freely as spirits, and is as nearly difficult to extinguish," but that is all he ever wrote about it. Neither the Father of Our Country nor Colonel Drake could know that from crude oil would be made houses and candy bars and 100-octane aviation gasoline.

Crude oil is a remarkably useful element. It is filled with hydrogen and carbon, just as is sugar cane and an ear of corn. Until the wide use of combustion engines, however, the existence of petroleum did not have much influence upon civilization.

World War I was waged so largely on foot because Americans had not yet established mass production.

From 1920 on, peace-loving America became bent on turning out as many automobiles, tractors, and other petroleum-consuming vehicles as possible. By 1938, the last full year before World War II, the United States was producing 3,469,000 barrels of petroleum liquids every day, and consuming 3,115,000 barrels at home.

In 1910 the United States demand for petroleum products was only 170,000,000 barrels for the entire year. By 1920, the demand was tripled to 436,000,000 barrels. In 1930, it was more than five times the 1910 demand, or 927,000,000 barrels. In 1938 it was one and one-eighth billion barrels!

What caused this rise of petroleum's importance? The answer is Nature, plus private enterprise.

Many years before the Indians came to the American continent, however, the Pennsylvania oil had been found useful by somebody else. There is evidence of ancient workings in the oil regions of Pennsylvania, Kentucky and Ohio. There remain the vestiges of carefully prepared oil pits, frequently lined with timbers,—and Indians did not engage in this type of construction. Possibly these workings were by the same pre-historic people who mined copper near Lake Superior.

But, before even these predecessors of the Indians, certain types of petroleum products were being used. The Tower of Babel was put together with an asphaltic substance, the walls of Babylon were similarly held together, and the bodies of Egypt's ancient kings, buried in the pyramids, were, in part, embalmed with some sort of bituminous product.

Therefore, man has known for several thousand years that there was such a thing as petroleum, and that it existed in several parts of the world. But it was not until about 1859 that Colonel Drake and his associates saw commercial possibilities in the viscous liquid. Drake, of course, was anxious to sell it in bottles for medicine, in barrels for axle grease and lamp fluids. And, as is attested by the fact that the British began buying petroleum in 1861, the demand for the product soon became international.

The hills adjoining Colonel Drake's well were soon dotted by derricks of the other "wildcatters," a most respectable business name for a man who is brave enough to risk his fortune to drill an oil well. They, like Drake, had to go down only 69½ feet, and the teeming surplus of crude oil depressed the price per barrel from $20 to 10 cents almost overnight. This low price remained for a few years until such "impurities" as gasoline were refined out of the kerosene, whereupon the price began climbing slowly. At the end of World War I, it stood at $6.10 per barrel. It has never equalled that figure since.

Nevertheless, American crude producers had the inside track on its production. As our civilization moved west, new fields were discovered. Oil wells drilled since 1859 have exceeded 811,000. Many were what the wildcatter called dry holes, or failures; but at the end of 1944 there were somewhere in the neighborhood of 411,000 producing wells, or about twice as many as at the end of 1918.

The wildcatter of Drake's day hired a diviner to find the proper place to start drilling a well. The diviner generally had enough common sense to make certain that there were "burning springs," or evidence of petroleum seepage, in the neighborhood. Then he went along with a two-pronged wooden fork upon which was suspended by a string anything from

PHOTO FROM THE BETTMANN ARCHIVE

a can of water to his false teeth. When it dipped, either because the diviner hiccoughed or grew tired of carrying the stick, he said that it marked the precise spot to start drilling. It was a haphazard method of locating a petroleum-producing anticline, but it was often successful. The wand-waving was largely hocus-pocus.

In these days the wildcatter hires geologists, who conduct costly surveys to locate the precise spot that might be over the dome of an oil pool. It is then necessary to drill down anywhere from 100 to 15,000 feet to locate this reservoir. There is a general feeling in the oil industry that there may be oil deposits even below the 15,000-foot level.

What is petroleum? It is generally agreed to be marine animal and vegetable matter that accumu-

lated millions of years ago in a depression on the floor of some great body of water. As time went along, the deposit became covered by layers of rock and shale. The organic matter was then slowly transformed into oil by long, continued heat and pressure, aided by decomposition and bacterial action.

Despite the fact that the oil man often speaks of "bringing in new pools of oil," deposits are, in fact, contained in porous or sponge-like beds of limestone or sandstone. Practically all deposits of oil are accompanied by natural gases, which originated from the same organic matter as the oil. In a majority of cases deposits of crude oil are surrounded or underlain by water, usually under pressure.

Therefore, the oil well is not like a cistern with walls. It cannot be operated steadily to the last drop. Petroleum must ooze out of the surrounding sandstone or limestone into the well, and oozing requires time. If the well is worked or produced—the latter term is preferred by oil men—too rapidly, little of the crude oil in the "pool" is obtained. Today, through recent improvements in production methods, it is possible to extract all but about 30 percent out of Nature's deposit. However, in earlier years, more oil was left in the ground than was ever taken out!

In the majority of oil fields, the active force working to bring the oil to the surface is gas. Where this force is great, gushers are brought in. This gas is usually found in solution within the oil, contained within the fluid in much the same manner as carbon dioxide is contained in a bottle of pop. Shake up a bottle of pop and flip off the cap, and you have a gusher. But if you allow the bottle to stand for some time without recorking, the pop grows stale and listless. The same principle is involved in an oil well. Although you cannot shake it up like a bottle, the forces of Nature, having put the oil there and added the gas, have provided the gusher qualities. If the gas is dissipated, the mobility of the oil decreases, and the crude cannot flow into the casing and tubing of the well.

In the old days the greedy oil man simply touched a match to the natural gas that accompanies the oil, and it burned merrily in large gas flares, illuminating the entire countryside. Today, however, almost every state has conservation laws that prohibit waste of this gas, and require its utilization as fuel, or its return to the oil sand for the maintenance of pressure within the reservoir.

For each oil reservoir there is a rate beyond which production cannot be sustained without waste of the natural reservoir energy and loss in ultimate oil recovery. This is called, in the oil business, the "maximum efficient rate." It is more often glibly spoken of as "the m.e.r." During World War II it was necessary to produce crude oil from wells in California, Texas, Louisiana and Arkansas above the m.e.r. There was no other choice because of the desperate need for petroleum.

The North American continent has proven oil reserves in excess of 20 billion barrels. The term "proven reserves" is somewhat nebulous and misleading to the layman. Experts decide that a pool contains so much "recoverable" or obtainable petroleum, if properly produced, and the figure is accordingly entered in the records. Therefore, if the oil men of the United States do not try to get all of the petroleum out of the ground as rapidly as possible, there are assumed to be at least 20 billion barrels to draw upon.

After World War I Americans were alarmed because they thought they had only 8 billion barrels of proven reserves. But, during the following few years, the figure was boosted to 20 billion, and there it stood until World War II. We produced from our wells an average of about 4,400,000 barrels every single day after entry into World War II, but the new fields discovered, as well as extensions of old fields, have enabled our experts to keep the proven reserves figure around 20 (Continued on page 162)

Then and now. The oil can used about 1870 to fill oil lamps at home is a far cry from the thousand of empty cans below that brought immense supplies of asphalt to the Marianas to supply the fighting forces in the Pacific with modern military highways and landing strips.

PAW PHOTO BY CORSINI

Bullsnake Men

By J. FRANK DOBIE

Illustrated by Russell O. Berg

"Crawfish Jim . . . reached inside his shirt and lugged out Julius Caesar, 'a-squirming and a-blowing, and madder than a drunken squaw.' "

TO MANY people all snakes are repulsive. I cannot remember when coachwhip snakes (the prairie racer) were not beautiful and delightful to me, although I have never had any inclination to fondle one. I do not have to pluck evening primroses to rejoice in them. Reading W. H. Hudson made me tolerant of all non-poisonous snakes, and as I learn more and more about those men whose principal characteristic is lying greed, I become more tolerant even of rattlesnakes. A part of the charm of any garden, and of all uncultivated Nature, is the little innocent snake. I enjoy them along with butterflies, birds and lizards.

There is something about a bullsnake that seems to attract some solitary men. There seems to be something about some solitary men that attracts bullsnakes. Anybody who has read Alfred Henry Lewis's Wolfville stories will recall Crawfish Jim. He was a sheep man camping alone out in the foothills of the Tres Hermanos Mountains. "Bullsnakes is the most domestical snake there is," he said. According to the Old Cattleman, who got off at Crawfish's camp one day: "When Crawfish gets ready to bile the coffee, he tumbles the biggest bullsnake I ever see outen the coffee pot onto the grass. Then he fills the kettle with water, dumps in the coffee, and sets her on the coals to stew."

"I call this here particular snake Julius Caesar," Crawfish explained. "He's too big to tote around in my shirt, and so he lives in the coffee pot while I'm away and keeps camp for me."

But, on one of his rare visits to Wolfville, Crawfish Jim did tote Julius Caesar, as well as all his other pets, along. After he had mellowed in the Red Light Saloon a while, and even the cowmen were drinking his health, he reached inside his shirt and lugged out Julius Caesar, "a-squirming and a-blowing, and madder than a drunken squaw." "I ain't no boaster," Crawfish Jim said, "but I offers a hundred to fifty that Julius Caesar is the fattest and finest serpent in Arizona, also the best behaved. . . . Whatever's the matter with you people falling back that way, anyhow? Thar's no more harm in Julius Caesar than if he's a full-blown rose."

Of course there was not, but the world's coarse thumb is always down on people like Crawfish Jim and Julius Caesar. One of the "sane" men drew his sixshooter and clipped Julius Caesar's head off. Crawfish Jim was unarmed. He went across the street, bought a sixshooter, came back, missed the head of Normalcy and the next second was as dead as Julius Caesar. He had eleven little bullsnakes in his clothes. Wolfville supplied an epitaph for the grave. It reads: "Sacred to the Memory of Crawfish Jim, Julius Caesar and Eleven Other Bullsnakes. They Meant Well but they Misunderstood Existence and Died."

I am dead certain that this story is based on fact. Years ago I heard Roy Bedichek, naturalist, and therefore observer; scholar and thinker, and therefore liberal-minded, tell about an old-timer named Navajo Bill and his pet bullsnake. Cooling ourselves under the shade of the big elm yesterday evening, I got Bedichek to tell the story again.

It was 1908 while he was living in Deming, New Mexico, that he made friends with Navajo Bill. Navajo was seventy-six years old at the time, had no visible means of support, but was furnished enough food to live on and enough whiskey to get cheerful

on by the saloon men and old timers in town. A half century back he had been a scout in campaigns against the Navajo Indians; hence his name. On one occasion, he used to tell, he was leaning over in the saddle and riding like a drunk Comanche to miss Navajo arrows when one of them shot its barbed iron deep into his right buttock. He could not pull it out and he could not sit down in the saddle. The Indians kept after him and he rode, leaning over, for eighty miles before he got to white people, and help, in Silver City.

"Nellie Gray glided out . . . across Navajo's leg and lap, up and around his arm, made a coil around his neck and then, placing his head against Navajo's cheek, paused. Navajo stroked the creature gently."

Old Navajo would not sleep in a house—except when he was drunk—and somebody bedded him down in the back end of Hannegan's saloon. His domicile was a canvas tent, with a twelve-inch pine board around the bottom of it, down the Southern Pacific railroad track two miles west of Deming. Chinese coolies had built that railroad back in 1881, had died like sheep, and the spot where Navajo Bill pitched his tent was in their ruined and well nigh obliterated graveyard. Old Navajo liked solitude. When dust storms blotted out the mountains, made the sun nothing but a round, smoldering red coal of fire, thickened the air so that babies could not breathe, and for days raged so unflaggingly that many a white woman went insane, Navajo Bill, as weathered and dry as a dry arroyo out of the bare New Mexico hills, would trudge against the west wind for two miles to the solitude, the solace, the retreat of his lone canvas tent in that abandoned Chinese graveyard, on a plain of unending emptiness where a dead tumbleweed afforded Nature's most conspicuous relief.

But Navajo Bill was not alone when he got to his sanctuary and home. He often told Bedichek about his friend out there in the tent, a pet bullsnake. For a reason that he kept locked up inside himself he called his pet Nellie Gray. One day Bedichek walked out to the tent with Navajo Bill to see Nellie Gray. The furnishings of the tent consisted of a stove, a few blackened cooking utensils and filthy dishes, a water bucket, a cot tumbled with dirty, ragged quilts, a box for clothes, and an empty nail keg to sit on. As visitor, Bedichek took the keg. Navajo sat on the cot.

"See that hole?" Navajo said, pointing to the ground beside a leg of his cot. "He may not come out, but be still and we'll see."

Navajo patted the leg of the cot. The hole, maybe three inches in diameter, remained empty. Navajo made a kind of clucking noise. Without saying a word, the two men waited. Once Navajo whistled low. Then the immobile visitor saw a long, slim and very graceful head cautiously emerge from the hole. Somehow it reminded him of the head of a doe.

"He'll have to get used to company," Navajo said, low. Again, he gave the clucking sound.

Very slowly Nellie Gray glided out, four, maybe five, feet of slender grace. He climbed the leg of the cot, glided across Navajo's leg and lap, up and around his arm, made a coil around his neck and then, placing his head against Navajo's cheek, paused. Navajo stroked the creature gently. Bedichek was not saying anything.

After a while Navajo said, "That's enough, Nellie Gray." He took Nellie Gray in his hands and deposited him near the hole, down which the snake soon disappeared.

"How deep is that hole, Navajo?"

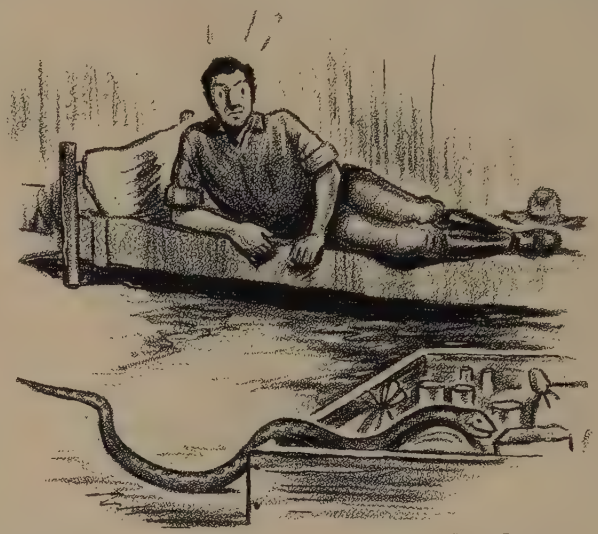
"The Indians kept after him and he rode, leaning over, for eighty miles before he got to white people, and help, in Silver City."

"Oh, I speck that hole goes down to the skull of one of them Chinks the railroad company buried back in eighty-one when they was laying the ties. I'll bet Nellie Gray is coiling up round that skull down there right now."

Answering questions, Navajo went on. "Eats any-

thing I eat, but he's specially fond of eggs. You oughter see him twist around a cottontail rabbit and squeeze it to a ribbon so he can swaller it. Rabbits is skeerce, though. Nellie Gray is good company all right. Sometimes he hisses and blows. I don't know what he's saying, but we understand each other."

I never have come across a bullsnake man myself, but I keep on cutting their sign. Sam Ridings up in Oklahoma tells in his book on *The Chisholm Trail* about an old cowboy who after being arrested on the charge of horse theft was found to be harboring a bullsnake in the bosom of his shirt, and only by bodily force could be separated from it. Peter Ellis Bean in the dungeon of Acapulco had as his only friend, and a very dear friend, a white lizard; a prisoner of the Bastille, as I seem to recall out of *A Tale of Two Cities*, had a pet mouse; the Prisoner of Chillon "with spiders friendship made"; but this poor old cowboy who "knowed he'd done wrong" was not permitted to take his bullsnake with him into jail. Maybe some day this country will grow tolerant enough that a man can enjoy, as well as kill, his own snakes without becoming a pariah.



"I raised up on my elbow to see what he was doing. He had his head in the sugar sack. . . . He took all of my appetite, eating out of the grub box."

Ending up his days out in California is Charlie Russell's old pardner from Montana, Con Price. He is a great hand to recollect, and this is the way he recollects a bullsnake man back in the days of the open range.

"Fred Reid was one of the old-time deer and elk hunters in the early days of Montana. He told me the first bear he ever killed was when he was a young boy. He had heard lots of stories about the ferocity of wounded bears and been constantly warned not to trust one. Fred was so scared he did not go near the bear after he shot it until he saw some flies buzzing around its mouth. He said that when he saw them he judged he had waited long enough for the bear to move. He hunted for the market, and said he often dogged elk all day on foot until he tired them out; then he would make the kill.

"He never wore stockings; claimed his feet kept warmer without them. He would take off his shoes and knock the snow out of them, put them back on and go on again. I believe he was the toughest man I ever knew. I never knew him to have anything in his camp except sourdough bread and coffee and wild meat. The coffee he made was so strong and bitter nobody else could drink it. The pipe he smoked would drive you out of the tent if you did not have an iron constitution. That pipe and coffee pot were 'Life' themselves, he said, and were his 'pals,' and he would never die as long as they 'lived.'

"After the freighting days were over, Fred went to work as a cowboy and took charge of a big outfit in the Judith Basin. He located his private headquarters in the bad lands of the Missouri River. It was surely a tough country to get in and out of; everything had to be packed in on horses. I asked Fred one time why he had picked such an ungodly country. He said he wanted to be alone where nobody would bother him. During the winter of 1891 he hired me to break horses. He had a dugout, no floor, a couple of bunks made of cottonwood poles. Soon after I arrived the sugar was all gone; so we had no sweetening the rest of the winter—just sourdough, that bitter coffee, out of melted snow, and plenty of deer meat. As soon as the weather broke so I could ride out, I quit Fred.

"Sometime afterwards I was back in that locality and went to his camp. There was nobody home. It looked like nobody had been there for some time. I looked around and found some grub. It was a very warm day in the summer; so I picketed my horse and laid down on Fred's bed in the dugout to take a rest before getting something to eat. While I was lying there I saw a snake's head appear out of a hole in the dugout. It was a bullsnake, and when he got his whole body out he was a monster. He was about four feet from me and saw me. He stuck his tongue out at me a few times and crawled across the dugout to where there was a grub box and got about half of his body in it and stopped. I raised up on my elbow to see what he was doing. He had his head in the sugar sack. I was twenty-five miles from where I could get anything to eat, but I saddled up and rode. He took all of my appetite, eating out of the grub box. I saw Fred some time afterwards and told him of my visit and of my leaving without eating. He seemed very much surprised that his bullsnake should bother me any. He said the big fellow had been with him a long time and that they were great friends. He also said the big fellow didn't allow no rats or mice to come near the camp."

★

Palm Forests

By ALEXANDER F. SKUTCH

A fruiting silico palm. Huge clusters of scaly fruits, heavier than a man can lift, hang from the top of the massive trunk, between the thick stalks of the enormous leaves.

PALMS range in size from humble shrubs that thrive in the undergrowth of tropical woodlands, flowering and fruiting when scarcely more than a foot high, to noble and lofty trees that hold up their heads among the giants of the forest. The wax palm of the Andes is said to attain a height of more than two hundred feet, and is one of the tallest of trees. The leaves of palms, known as fronds, are usually made up of many narrow divisions, springing from a stalk so long and heavy that the uninitiated often call it a "branch." When these divisions are attached along both sides of a central stalk, like the barbs of a feather, the plant that bears them is called a "feather-palm"; when they spread fanwise from the end of the stalk, often joined together at their bases, they belong to a "fan-palm." Rarely, palms have simple, undivided leaves. But whether it be a giant or a dwarf, has fronds like feathers or like fans in form, there is something in the aspect of a palm which, even to one with no knowledge of botany, sets it apart from all other plants, and causes it to be recognized at once. Well have botanists given the name *Principes* to this noble group of plants—Princes of the Vegetable Kingdom.

Usually I have found the taller palms growing singly or in small groups in the tropical forests, among broad-leafed trees, which rise above them. Sometimes, as along the narrow crest of a steep ridge, they may form small groves of limited extent. Rarely are palms the dominant form of growth over an area of considerable extension; rarely are forests made up of palms alone.

But along the Atlantic coast of the tropical American mainland, from the mouths of the Amazon to Nicaragua, grows a noble palm that may, at times, be the dominant tree over extensive tracts of low and swampy ground. This palm is called *silico* in Panama, *yolillo* in Costa Rica. Its scientific name is *Raphia tædigera*. It is so similar to a form that grows on the west coast of tropical Africa that for a long while it was considered to be the same species. It is an interesting case of a tree which, without man's aid, has crossed the central portion of the Atlantic Ocean with very slight variation in its structure botanically.

Tourists who visit Costa Rica, and make the railway journey from Puerto Limón to San José, can hardly fail to notice the stands of this striking palm. It is found only in the low coastal plain near the port, before the road begins to climb into the mountains. In places the huge, dark-green, plume-like fronds cluster close to the tracks on either side. But these particular swamps give no idea of the size the palm may attain. The most impressive stands of the silico palm that I know are found across the border in Panama, between the Sixaola River and Almirante Bay.

When I lived in this region, some years ago, I made frequent visits to a certain low, swampy tract of land where these majestic palms grow in almost pure stand. Here they form the most strange and awe-inspiring forest it has ever been my lot to enter. The thick, columnar trunks, often fifty feet high and ragged with the persisting bases of the older dead leaves, are surmounted by crowns of tremendous fronds, which are as long as the trunk is high. Despite their gigantic size, these leaves, composed of hundreds of slender, ribbon-like divisions crowded along the length of the massive stalk, are feathery

Fruit and seed of the silico palm. At left is a fruit, covered with glossy scales directed backward toward the point of attachment to the stem. At right, below, a fruit cut open, and, above, a seed from a larger fruit.

and graceful in appearance as an ostrich plume, and entirely lack the stiffness of the far smaller fronds of the manacca palm.

Each tree lives for many years without flowering, then, by a tremendous effort of reproduction, forms at its crown a huge inflorescence, consisting of four or five branches from nine to twelve feet long and crowded with myriad small, woody, yellowish flowers of both sexes, the male greatly predominating. The latter, after shedding their dry pollen, persist on the stem and decay, while the female flowers develop into fruits of unique appearance. They are as large as a goose egg and entirely covered with broad, triangular scales, which point backward and are of a russet color with a high gloss. When I brought some back to the plantation, our cook requested one for use as a darning "egg." The entire ponderous cluster of them weighs far more than a man can lift.

Exhausted by the vast expenditure of material necessary for the production of so many flowers and fruits, the palm dies after its single crop of seeds has ripened; but it is surrounded by numerous other stems that arise as suckers from its subterranean portions. The oldest of these daughter plants are already nearly full grown, and have given rise to sprouts of the third generation; and these in turn bear offshoots whose stems have not yet risen above the ground. All continue to grow until each in turn is ready to fruit. Thus the palm grove consists of many separate clumps, each of which has sprung from a single seed and contains trees of all ages.

The watery soil beneath the palms is almost free of other vegetation. In the wetter parts of the forest a man sinks into the muck about to the level of his knees, but his further submergence is halted by the rope-like horizontal roots that run in great numbers a foot or two beneath the surface. From these anchoring roots, innumerable breathing roots grow upward through the muck and extend a few inches into the air, where they branch profusely; their vast numbers cover the surface like a sward composed of some stiff, brown grass. Where more solid mud is exposed above the water, especially about the edges of the swamp, it is imprinted by the cloven hoofs of the peccaries, which come to feed upon the thin, orange-colored inner layer of the fruit. This seems to be agreeable to them despite its bitterness and lack of appeal to the human tongue.

A visit to one of these swamps covered with gigantic palms in crowded ranks is an experience never to be forgotten. With mixed emotions I wandered through the dim passageways between the palm clumps. There was much that repelled in the marshy ground with its uncertain footing, in the massive trunks ragged with the decaying remnants of earlier fronds, among which a variety of attractive ferns found a congenial soil. But this slight feeling of repulsion was overawed and subdued by the majesty of the huge, plume-like leaves that interarched so high above me, lifting the spirit at the same time that it impressed a sense of awe and reverence, as in the nave of some great cathedral. Amid this titanic display of the exuberance of tropical vegetation, I felt hardly more effectual, and no more important, than the tiny green tree frogs that tinkled like little silvery bells among the trunks of the forest palms.

Silver Bird

By MARION DOYLE

Turning from the highroad,
Down a little lane,
I came upon a silver bird
Singing in the rain.

Feathers curved like water's
Crystal eddying,
He broke into a silver song
Such as waters sing.

Breathless, I stood waiting
For each radiant note,
And though I could not understand,
Rapture clutched my throat.

Two young egrets, just out of the nest, take a few first steps practically hand in hand.

A Rio Grande Heronry

By GEORGE McCLELLAN BRADT

Photographs by the Author

WEST of El Paso, where the Rio Grande flows out of New Mexico to form the international boundary between Texas and the Mexican state of Chihuahua, lies a dense salt-cedar swamp, the nesting site of numerous snowy egrets and black-crowned night herons, discovered by a member of El Paso's Bird Club.

My wife and I visited it in early July. In the very center of the almost impenetrable tangle of tornillo and black willow, some twenty-five pairs of gregarious egrets and herons had built their coarse stick nests. All were between ten and twenty feet above the damp, leaf-covered ground, and all but a few, among the swaying branches, were occupied by pale bluish-green eggs, feeble babies, or well-feathered birds about ready to leave the nest for life. Even the empty ones showed signs of recent tenancy; fresh "white-wash", broken shells or

dead young were caught in the labyrinthine mass of branches below their nests.

The adults, vehemently protesting our invasion of their sylvan nursery, subjected us to a weird combination of raucous barking threats and hysterical cries of advice to their progeny. Occasionally they took time out to perch precariously on the topmost branches and peer down at us through the leaves. An exotic sight they made—slender-necked, marble-white egrets and soft gray, black-headed herons among the brilliant green branches against a deep blue desert sky.

The young birds themselves maintained absolute silence as they froze on nest and limb. Only after we had concealed ourselves under a canvas blind did they make a sound, and then only a queer, insect-like buzzing. Apparently this strange noise signified hunger, for within a few minutes the young egrets were stretching forth long necks, and baby herons were opening their extraordinarily wide mouths as their respective parents returned with beaks full of fishy food. Those young already out of the nest immediately began climbing up through the interlacing branches to meet their parents. They executed this difficult maneuver by a singularly unbirdlike use of their beaks. We watched one egret in particular. He began walking up the branch on which he had been perching until he

Clutching a salt-cedar branch, an ungainly, great-mouthed young night heron waits to be fed by his far handsomer parents. Below, two weirdly-marked young black-crowned night herons in a vain effort to remain unseen in their home nest.

could go no further. Then he crossed over to another, and slightly higher limb, by grasping the latter with his strong beak, and then chinning himself until high enough to get a good grip with his long, finger-like toes. In this manner he progressed rapidly and surely until he reached his parents, who rewarded his efforts with a regurgitated tidbit thrust far down his snaky white neck.

While the feeding was in progress, we took time to observe the dark moist ground about us. It was littered with an amazing array of heron debris—broken egg shells, downy feathers, dead young fallen from the platform nests, innumerable small, blue fish and green frogs, slimy grayish pellets cast by the nestlings. As can well be imagined, the atmosphere, both visual and olfactory, was overwhelmingly piscatorial. But the heronry's avian inhabitants themselves were immaculate.

Our last visit, about the first of August, netted us only a glimpse of a few large, well-plumed young high in the tree tops.

Three pale blue-green egret eggs lie close together on the rough, flat nest high in a green tree. Below, while one nestling egret tried to make himself invisible by freezing in the nest, his brother wobbled backward and forward on thin legs.

At the upper left is a picture of *Tillandsia utriculata,* growing upright on a slender branch of an oak. The branching flower-stalk reaches nearly to the horizontal limb above. At the right, above, the butterfly orchid, *Epidendrum tampense,* the commonest orchid in Florida, is found well up into the central part of the State. Left, *Tillandsia fasciculata,* with a group of these air plants growing from the side of a tree trunk, and with a number of the flower stalks in evidence. Farther down the tree, is the butterfly orchid.

Hanging Gardens

By HUGO H. SCHRODER

Photographs by the Author

FLORIDA is a land of contrasts. There violets from the North nod in acquaintance with tropical flowers of the West Indies; parasitic and epiphytic plants of many kinds make a profusion of hanging gardens as they grow in the trees.

An epiphyte is a plant that is mechanically but not physiologically attached to another plant. Such a plant growing on a tree uses the tree as an anchor, but draws its sustenance from the rain, dew and air. A parasite, such as mistletoe, draws its strength from the host.

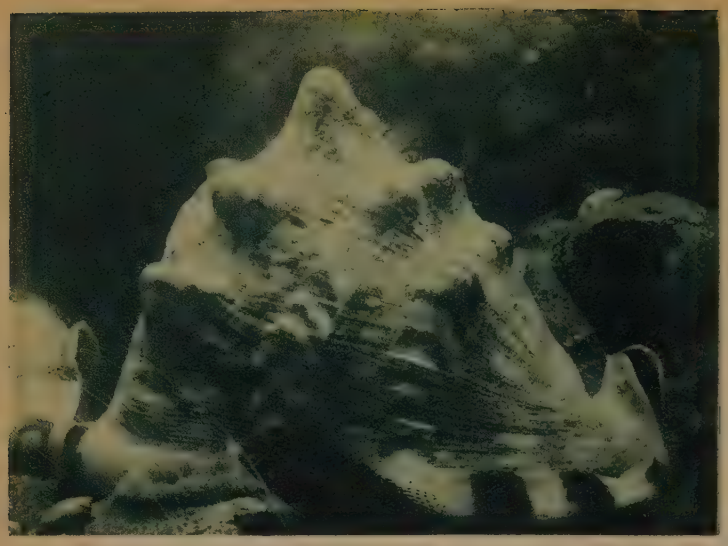
Spanish "moss" is perhaps the most familiar epiphyte in Florida, and the most widely distributed. The main stem of the plant grows with a spiral twist, with several curved leaves appearing along the stem every inch or two. Small, greenish flowers appear during the spring and summer, and are slightly fragrant. When the sheath

Clusters of mistletoe, above, grow in the tree tops. This photograph was taken in winter when the leaves of the host tree had fallen, leaving only a few stray wisps of Spanish "moss" below the parasitic plants. Right, above, several species of tillandsias grow on the cypress trees of the Big Cypress swamp in south Florida. This photograph was taken after a very dry winter. The normal water marks may be seen on the trunks of the trees near their bases. At right, Spanish "moss" adorns cypress at lake near Orlando, Florida.

holding the seeds opens, the winds scatter the seeds, many finding anchorage in crevices in the bark to start new plants.

Several species of *Tillandsia* are among Florida's epiphytes, the common *Tillandsia fasciculata* resembling an arboreal pineapple plant. Their flaming crimson bracts make them showy ornaments of swamp trees; their flowers are narrow, purplish-blue blossoms about an inch long.

More than a score of epiphytic orchids add their beauty to the swamps and hammocks of Florida. The commonest is the butterfly orchid, with dainty greenish-brown blossoms. The most showy of the tree-growing orchids is *Cyrtopodium punctatum*, with greenish flowers spotted with purplish-brown borne on a flower stalk sometimes five feet tall. One of the strangest tree orchids is *Polyrrhiza lindenii*, which consists of a cluster of roots fastened to the bark of a tree and an attractive white flower on a short stem, the blossom having a long spur. A tiny orchid, *Harrisella amesiana* is in contrast to its larger relatives, bearing a few minute greenish blooms in summer. Study of the Florida tree orchids is a fascinating adventure in botany.



An underwater photograph of the king conch, *Cassis madagascarensis*, crawling along the bottom. This mollusk is found from North Carolina to the West Indies. The aperture of the shell is rich black and cameos have been cut from it.

The under side of the king conch shown at the top of the page. Below, horse conch. Within is a pearl of golden color, the same color as the interior of the shell. This was a round ball pearl weighing fifty-four and one-half grains.

Conchs and Their Habits

By LA PLACE BOSTWICK

Photographs by Gene LaFond

ERIC the Red raised a conch shell to his lips to signal his Viking ships to start on their westward journey. The wild hordes of Europe used such shells before civilization came. New England farm wives called their men from the fields with conch horns brought home by New England men who sailed the seven seas. History tells us that "shells of the conch were sometimes used as trumpets by the Trojans and by the early Romans."

The "Ten Thousand Islands" lie just west of the Everglades of the coast of southwestern Florida. A maze of winding water passages twines between mangrove-covered shores. Among the small and scattered population are the descendants of pirates and buccaneers, hospitable to a stranger if he asks no personal questions. If he proves inquisitive, he is likely to be told: "We don't aim tu inconvenience yo none, Mister, but it ain't absoLUtely necessary tu our happiness fer you to remain in these parts."

Worming its way in and out between the islands is an arm of the Gulf of Mexico called "Lost Man's River." In its exact center, miles from the Gulf proper, and enclosed on all sides by black mangroves and their more primeval cousins the spider mangroves, there is an island composed of conch shells. It is an American kitchen midden, built there long years ago by a vanished people. This island covers about an acre, and, curiously, each shell has a round hole drilled through it, each perforation similarly located. Implements of shell and flint and bits of pottery are strewn about. I camped there for several weeks and, at times, the spot reminded me of Dante's Inferno; at others, it was rarely beautiful with moonlight effects and the soft glow of phosphorescent water.

Conchs—which is pronounced *kongks*—are a sort of giant snail, creeping about with their homes on their backs. Anatomically they are quite similar to other large snails. When moving, the conch extends a considerable portion of its body out of the shell and reaches forward with what is known as the foot, which is armed on the ends with a long, curved, knife-like claw. This is pressed into the sea bottom, and the shell is drawn forward by a strong contraction of both the body and the foot. During each effort a distance of perhaps a foot may be covered. The creature can also turn over in either direction by simply throwing its foot to one side, giving a strong twisting pull after the claw is set.

Exterior and interior views of the great pink conch or queen conch, the most prolific pearl producer among the univalves. At the right we see, inside the shell, five "attached pearls" good for costume jewelry. In the inset are three queen conch pearls; first, a slightly colored perfect ball; next, a large, pink, gem pearl, and a white perfect sphere.

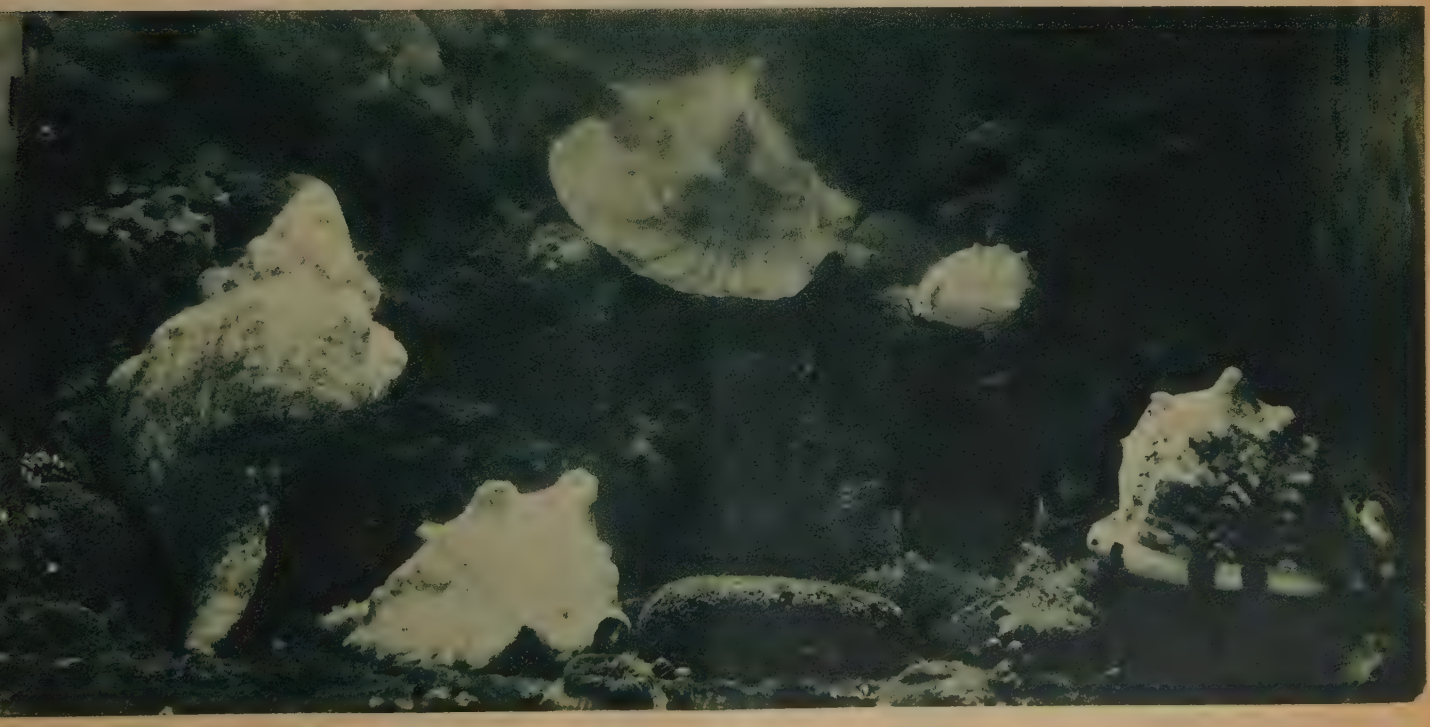
The variety of conch most common in the Gulf of Mexico is the horse conch, *Fasciolaria gigantea*. It is long and rather trumpet-like. The interior is yellowish, sometimes golden, and occasionally a golden pearl is found. This species is widely distributed throughout the world, and its shell was used by the Norsemen and early clans.

When the Spaniards and English first settled in the West Indies, they found an abundance of a beautiful conch not known in the old world. This was the queen conch or great pink conch, *Strombus gigas*. Great numbers were shipped to England for use in manufacture, and the flesh of the animal was found to be highly nutritious. Also, pearls were found. The Queen conch is found only within a region embraced by the West Indies, the Bermudas and the south Florida coast.

The outstanding characteristics of this conch are the extreme beauty of the interior of its shell, and the long, horny protuberances that spiral around the exterior. Queen conchs often move in groups, like flocks of sheep, two hundred often being seen together near reefs. Each is equipped with two well-formed eyes, which are located on the extreme ends of flexible, stem-like organs, with a small elephant-like trunk at the tip, this being the mouth. When eating, the conch extends and contracts this at will. It sometimes extends to a length of four inches. The food consists of minute animal and vegetable life.

Professional conch fishermen — known as

An underwater picture showing five different varieties of conch that may be found in the waters of south Florida, or in the region of the Gulf and the West Indies.



Underwater picture of varieties of conch. Below, a beach at Key West, Florida, where one may find conchs while in wading. Many thin-lipped conchs, which frequent shallower water, were gathered here.

A scene common in the Bahamas and south Florida, where one must go if he is to seek out the secrets of the conch and glory in the varied shells of this part of the world.

"konks"—usually get the conchs from a boat, using a water-glass and a long pole with an iron hook on one end.. While one man takes care of the boat, the other leans over the side, locating the conch by the water-glass, slips the hook under the shell and brings the animal to the surface. Some fishermen prefer to dive for them.

When Columbus first landed in the Bahamas, he found that the Indians owned large pink pearls of a kind unknown to Europeans. These were pearls made by *Strombus gigas*. They were largely oval or elongated in shape, round conch pearls being rare. Pink, red, white, yellow and, occasionally, deep rich brown pearls are found; rarely a golden one.

As the Bahamas and south Florida were settled these pearls appeared in London and Paris. The larger and finer pearls drifted into the collections of crowned heads, and to the princes and rajahs of India. The crown of Sweden bears a large conch pearl from Key West.

Conch pearls, however, seem relatively little known and appreciated in the United States. The finder of a large and perfect conch pearl offered it for sale, some time ago, in Miami, without getting a reasonable offer. New York gave the same result, but the pearl sold to a Bond Street jeweler in London for $10,000.

A few years ago I experimented with pearl-growing on Key Largo. My base was a house-boat, and a hurricane broke up both it and my conch collection.

The structure of conch pearls differs from that of other pearls. They have a peculiar wavy appearance, and a sheen somewhat like watered silk. Both conch and abalones have a more profuse secretion of pearly nacre than other mollusks. The layers of pearly deposit are less transparent than in other pearls, but the finest conch gems have an exquisite beauty quite different from the commoner Oriental pearls.

Conchs, then, are most fascinating, both the species briefly mentioned here and other species found in these southern waters. Study of these and other Florida shells is endlessly interesting and, with the possibility of coming upon a conch pearl, is touched with adventure.

As We See It

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Goose Slaughter at Horseshoe Lake

THE dangers that still beset our waterfowl are well typified by the recent slaughter of Canada geese at Horseshoe Lake, Illinois. This is a state refuge, and it was made a wildfowl shambles during the open shooting season just past.

Horseshoe Lake Game Refuge, near Cairo, Illinois, was established in 1927, primarily for waterfowl. About 35,000 birds, principally geese, were there in 1944; in 1945 the population was estimated at 25,000. The open season covered the daylight hours of November 24 to 28. No shooting was allowed on the refuge itself, but on the privately owned land close beside it blinds and other facilities are furnished gunners at a rental charge of about ten dollars a day, and as many as 1400 hunters can be accommodated. The kill of geese on the first day was about 1400, and when the shooting was stopped by the Federal authorities on November 28, about 6000 birds had been killed. This was slaughter at the rate of more than four every minute during the legal hours for shooting.

Next to shooting grounds actually on refuges, allowing gunners to shoot just outside areas that the birds have learned to consider as sanctuaries would seem to constitute a condition that is indicative of a low level of reasoning. Those who rent the shooting privileges claim that this is their living, and they should not be deprived of it. But some people take the ground that no one has a right to participate in the extermination of any wild creature for profit.

The story of the war waged by conservationists to prevent the utter destruction of our waterfowl resources, by those who profit in the process, is a long and sad one. For many years men made a living by market hunting, but the sale of all game was finally prohibited. As the stocks still dwindled, baiting and live decoys enabled the selfish ones to reap more than their share of waterfowl. Meanwhile the establishment of Federal refuges that should include shooting grounds was vigorously sought for several years. But the principle of inviolate refuges triumphed in 1927, or so we thought. Since that time many Federal and State refuges have been established.

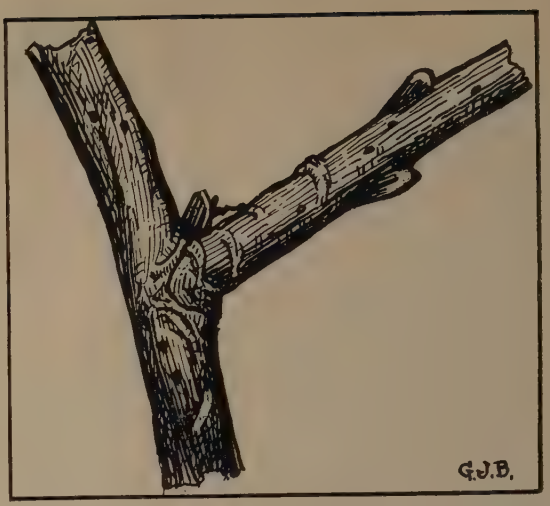
In the case of a few, the opponents of conservation were able to force the inclusion of shooting grounds. And, as time goes on, it becomes increasingly evident that powerful minorities still seem determined to sabotage existing controls in favor of the killers. Every year bills are sponsored by national and state legislators that, if enacted, would destroy the protective structures that were so laboriously built up by the conservationists of a generation past.

Only a few months ago three such bills were proposed, sponsored, strange to say, by the Chairman of the Select Committee on Conservation of Wildlife Resources of the House of Representatives. Reports of hearings on these bills describe them as advocating public shooting on portions of wildlife refuges purchased with "duck stamp money" and by law inviolate; the issuance of permits to feed migratory birds; the use of a limited number of live decoys.

The editor of the sportsman's magazine, *Field and Stream*, comments on these, saying: "As to what will be the outcome of these hearings I cannot say, but I came away with the feeling that Dr. Gabrielson and the Fish and Wildlife Service are doing an excellent and conscientious job in the face of many headaches and much pressure. If the Service should listen to one-half of the requests that are made, there wouldn't be a duck in North America by the first of January." And yet, within a few days, another dangerous-sounding bill was introduced, seeking to amend "the Migratory Bird and Hunting Stamp Act by providing that not more than 50 percent of any waterfowl refuge may be opened to public hunting and wildlife management."

Seemingly, only by invoking the unwritten laws of justice, common sense and decency can such outrages as the Horseshoe Lake case be prevented. And, of course, this particular case is not unique. By and large, the immediate surroundings of all sanctuaries should be controlled, for enemies are in our midst, alert to force laws making a mockery of conservation.

Destruction of our national wildlife resources is "big business," with countless ramifications and vast wealth, while the job of guarding them from commercialization, relatively speaking, is carried on in a few small establishments, in obscure places, and with scant resources save spiritual ones.



Dutch elm disease fungus growing in a bark beetle gallery. Each sac contains thousands of spores. These spores, mashed from the sacs, adhere to the "David" beetle's body, and are then carried by him from diseased elm wood or bark to infect the healthy "Goliath" elms. At the right an adult bark beetle feeds in the twig crotch of an elm, breaking down the sap vessels into which the spores will drop and carry the infection through the sap system of the elm.

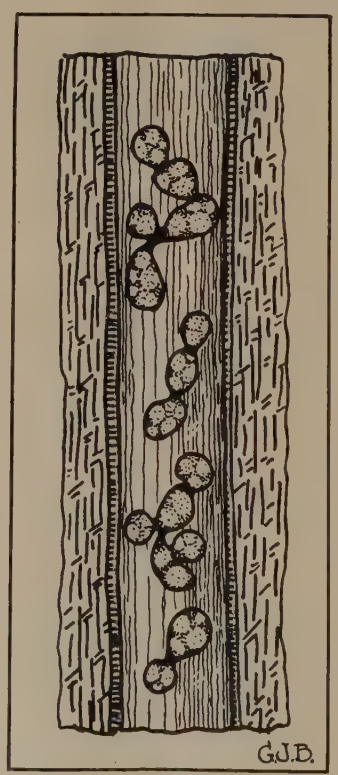
Goliath Is the Elm

By H. J. DODD

By the accident of his association with an immigrant tree-killing fungus, the "David" of this story becomes the slayer of many a "Goliath." David is represented by millions of tiny, hungry bark beetles, known to scientists as *Scolytus multistriatus* Marsham. These bark beetles entered the United States from Europe about 1904. Upon their arrival they found some of their bark beetle relatives, of the species known as *Hylurgopinus rufipes* Eich., already here, as they are native to North America. It was not until many years later, however, that the arrival of another immigrant, the tree-killing fungus, *Creatostomella ulmi* Buisman, which causes the so-called Dutch elm disease, furnished the native and the introduced Davids with microscopic but effective missiles, which they have been using since 1930 with unwitting but telling effect upon Goliath.

Goliath is the American elm, that majestic symbol of shade and symmetry so familiar to many of us on Elm Streets in this country. This shade tree already had many natural enemies before 1930, when the Dutch elm disease fungus was first reported from elm material in the United States, having been introduced by infected imported timber. But the *Scolytus multistriatus* beetles soon assumed the predominant role of David by the frequency with which they transmitted spores from diseased elm wood, or bark, to healthy elm trees.

The bark beetle Davids are from one-tenth to one-eighth of an inch in length, and the fungus spores they carry are so small that hundreds of them together are invisible to the unaided human eye. In these respects the protagonists of this story differ from the Biblical David and Goliath, but this latter day reversal of roles does not prevent diminutive bark beetle Davids from assaulting the elm Goliath.

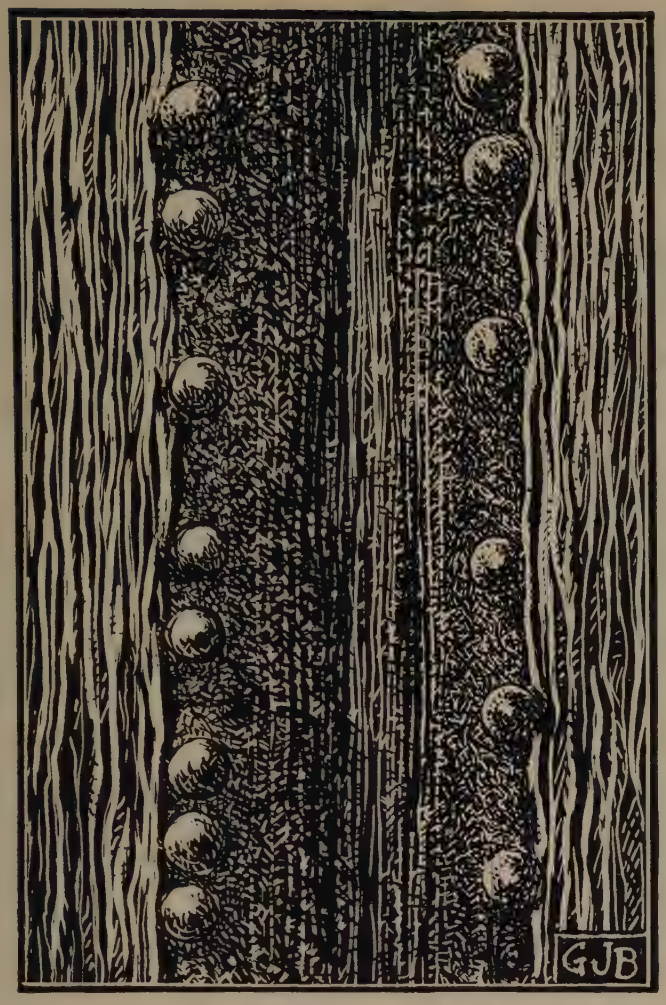


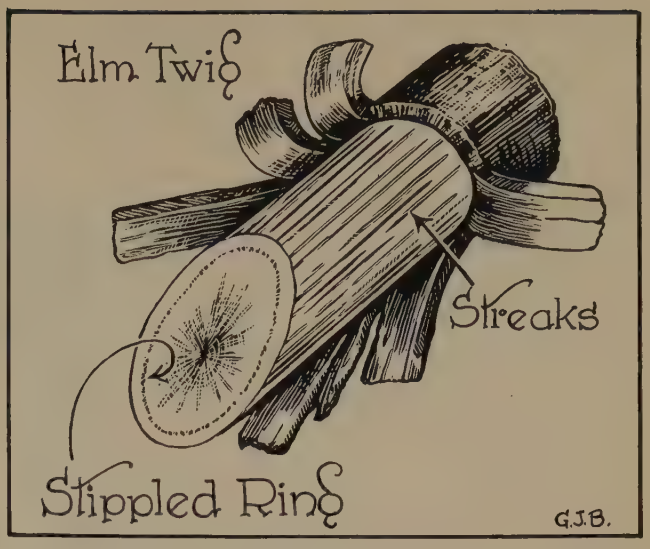
The yeast stage of the Dutch elm disease fungus developing in a sap vessel of an elm.

The coremial sacs that hold the spores of the deadly elm fungus look something like dwarf lollypops, or Lilliputian white cherries. They grow in tunnels chewed by bark beetle Davids between the bark and the wood of an elm.

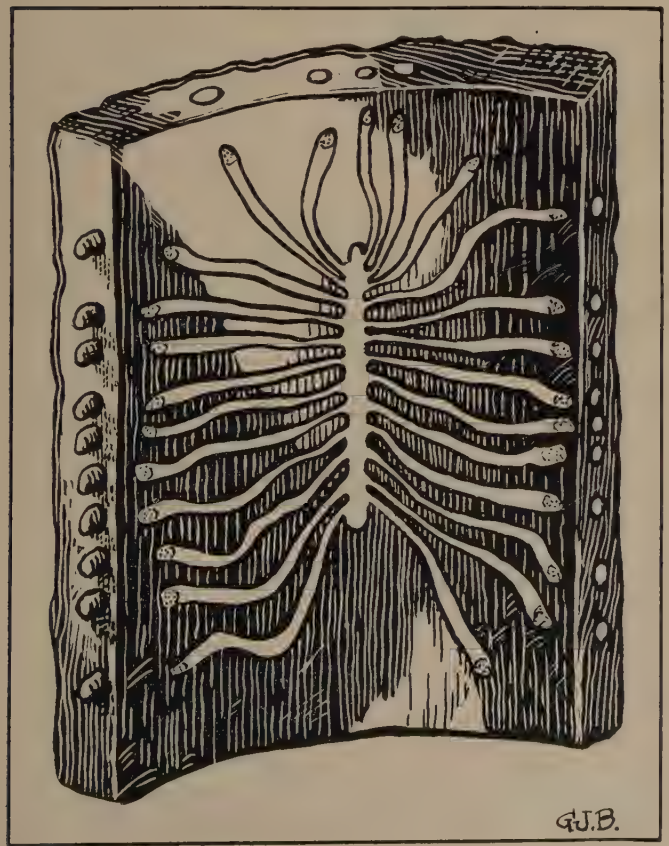
When David accidentally picks up these spores on his body and carries them to a healthy elm tree, he is too intent on gorging upon the tender new bark of a twig crotch to be conscious of the role of Typhoid Mary—to mix metaphors—that he is enacting. While he is chewing voraciously, some of the spores may be dropped into the wreckage of sap vessels broken by his feeding. In this haphazard manner the deadly spores of the Dutch elm disease get into the sap stream of the elm, and begin their undercover tour of sabotage.

Having thus gained entrance into the elm's sap system, the fungus undergoes a startling physical transformation. It develops yeastlike buds, and, in this form, it is carried by the sap to various parts of the elm. At any time, during its up-and-down movement within the sap-conducting tubes of the elm, the fungus may block the flow of liquids from the roots to the leaves. It may also





At the left, the enlarged portion of a bark beetle egg tunnel, showing the position of the eggs laid on both sides. Lower left, a fragment of elm bark showing the "coat of arms" engraved by bark beetles. Grubs are mining toward the outer bark. Above is a cross section of an elm twig showing a characteristic stippled ring. The bark is peeled back to expose the streaks in the cambium.



weaken and rupture the walls of the sap tubes. Such a blockade causes the leaves to change color, wilt, and die. Twig tips curl into the formation known as a "shepherd's crook," and, in time, the affected branch or the entire elm dies.

An elm that is dying because of invasion by the Dutch elm disease fungus is particularly attractive to bark beetle Davids. They throng to the dying giant like knights of the road to a free banquet, and burrow enthusiastically beneath his hoary hide. They begin engraving their coat of arms between the bark and the wood, digging short egg tunnels parallel to the grain of the wood. Then, somewhat like farmers sowing seeds, they lay dozens of round, opalescent eggs along both sides of these channels. After a short incubation period, the eggs hatch into hungry, white grubs. The grubs immediately begin eating their way out into the bark. During an extended orgy of chewing, while they are developing from tiny larvae into adult beetles, they finish carving the lateral arms of their heraldic shield, which gives the brood gallery the appearance of a careless wood engraving.

Although owners of valuable elms cannot see the disease spores that actually kill or maim their elms, they can see evidences of the presence of bark beetle Davids that spread the disease, and of damage done by the fungus in discoloring the sap-conducting vessels.

Woodpeckers like to feed upon the grubs maturing in the lateral larval channels. If woodpecker work, consisting of pecked or shredded bark, is seen on an elm branch or log, there is good reason to suspect that the Davids of this story are waiting in their sub-

bark airdromes to swarm out at the proper stage of their development, and to attack vulnerable elms in the vicinity. If woodpecker work of a previous season is present, it is possible that many of the Davids have already taken off on their flight and have found certain elm victims.

Not all cut or damaged elm trees, logs or branches with bark on them are dangerous in spreading Dutch elm disease. Some of them may be too old, too long dead, with loose, dry, or rotting bark that will not sustain bark beetles. These Davids are tricky pygmies, however, and if their presence is even suspected elm owners should make a thorough search of elm wood in woodpiles, slash on the ground, logs and broken branches. By breaking elm bark in the hands one can determine whether whitish grubs are developing in the tips of larval channels.

If grubs are discovered, they may or may not be the progeny of the Davids of our story, but it is high time to call for expert advice from local tree wardens, commercial tree experts, State experiment stations, or the United States Department of Agriculture. It is not necessary to confirm the presence of grubs before seeking advice from these agencies. Yellowing, wilting, or dropping of the leaves in summer, bent twig tips, weak bud development, woodpecker work in winter—all are symptoms that should make the owner of valuable elms suspect the presence of the Dutch elm disease. Brownish streaks in the wood or discolored, stippled rings in a twig cross section often mean that the fungus has become established in an elm.

However, none of these signs are specific proof that the elm material involved has been attacked by the Dutch elm disease, because other wilt diseases exhibit similar symptoms. It is always wise, therefore, to call for expert and prompt diagnosis of local elm troubles before attempting to apply extensive control measures to save the beauty and shade of your elms.

A woodpecker searching for juicy bark beetle grubs on an elm branch. Such an activity, particularly in winter, may be a sign that your elm trees are in danger.

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Tané's Garden

By SUSIE JURD

Where the mountains lift cold shoulders to the heavens:
Where the rivers first find streamlets, there to flow;
Where the Tui lilts a note of purest pleasure,
And man's destructive way has yet to go.

Where the Bellbird chimes away the leisure hours,
Where the bush trees, tended only by God's hand,
Strive to lift their leafy branches up to heaven,
From roots deep planted in Maoriland.

Where the days pass by unnaméd and unnumbered
For no autumn leaves mark there the passing years.
Where for every little forest bird that's fallen
The rain drenched tree tops shed their dripping tears.

Where the night wind croons a tune across the ranges;
Where the Kiwi ventures out at close of day;
Where the Morepork's piercing cry rings through the woodlands;
And the silent moon pursues its starry way.

Where the morning mist hangs low in every gully;
Where the bush birds sing to greet each day begun;
And the purple shadows on the mountains falling
Reveal approach of night when day is done.

Where New Zealand's birds and little native creatures
In hill and dale find sanctuary and rejoice;
It is here that Tané, god of all the forests,
Has kingdom in the garden of his choice.

Silverfish, Rayon Enthusiast

By CARLETON A. SCHEINERT

INNOCENTLY seeking food, the silverfish has become marked as a personal enemy by milady. They happen to love the same things.

A neighbor, preparing for a party, opened a box containing three new pairs of sheer rayon hose, carefully saved for such occasions. A hole had been eaten through all three pairs; through every fold from the top to the bottom. A silverfish had had a meal.

Silverfish, well known as devourers of paper, also enjoy good rayon fabrics. It is not the paper itself that is so appetizing, but the chemical pulp that goes to make up its composition. Chemical pulp is cellulose, and so is the basis of the artificial silk that goes into so many of our modern fabrics.

Unlike the clothes moth, whose larva alone destroys our woolens, the silverfish is an active feeder throughout its life. It wanders, loyal to no one location. Feeding its stomach is the "thought" uppermost in its "mind."

Scientists, studying the physical make-up of the silverfish, say it does not select its food by sight, its eyes being unable to form an image. It can only tell light from darkness, possibly distinguish masses of substances.

The silverfish, *Lepisma saccharina.*

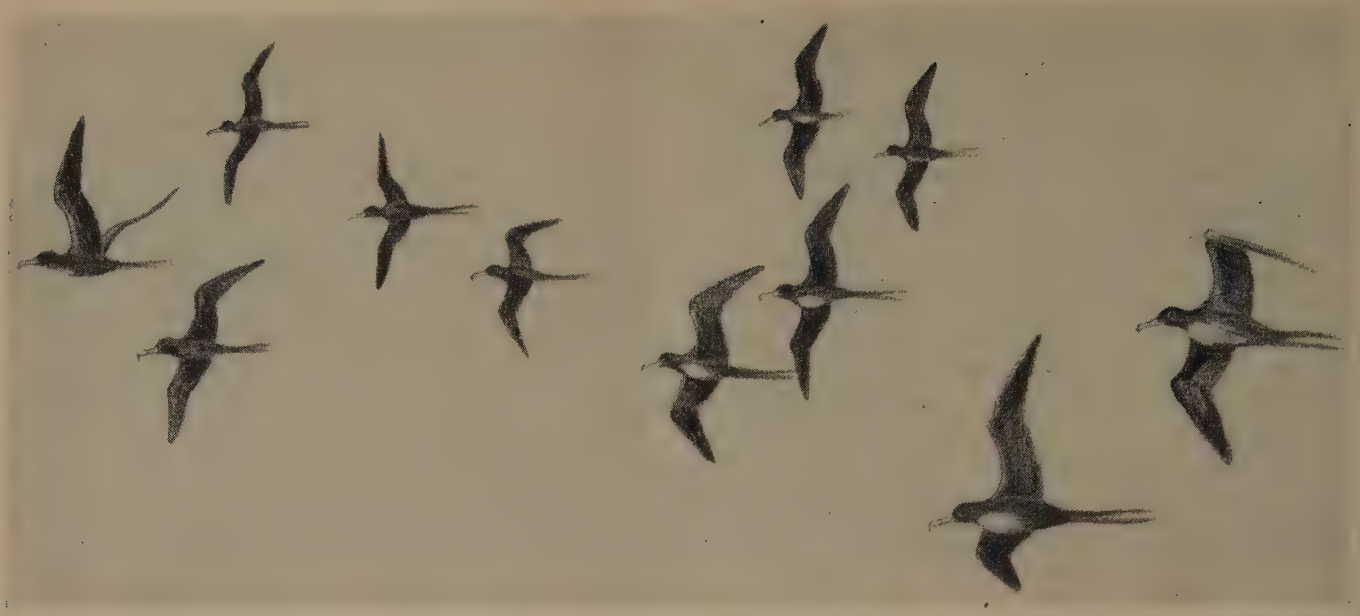
Watch this insect as it travels; see how it turns first in one direction, then another, its long antennae actively feeling the surface over which it travels. It runs a little way, stops and repeats the performance. It is believed to have a sense of smell, but it seems to have to get on the material to know whether it is edible or not, relying on its sense of taste. If the material is soft it is raised up and shoved into the silverfish's mouth by the palpi; if there is a fiber, as in woven rayons, the toothed mandibles saw through the fibers, making an irregular but cleanly-cut hole in blouse, dress or stocking.

A blouse, taken from a dresser drawer after a short stay, had a hole in its front, the cloth fibers clipped off regularly, the result of the saw-like action of the mandibles. The fibers surrounding the fairly clean hole had not been touched. The silverfish had taken just enough for its proper meal. Favored materials that remain undisturbed are invitations for the insects to remain, or to return for another meal—if they can find their way back. Modern industry has introduced artificial silk in so many guises to the home that silverfish seem much more prevalent and widespread than ever. As they multiply they spread, each seeking its own supply of food.

Means can be taken to control this pest, although total elimination is doubtful. Perhaps one could drop an old rayon blouse in the corner of the dressing room with the pious hope the silverfish will seek no further for a meal. However, that is a doubtful method, because of their gypsy-like habit of wandering between frequent meals. A box — the cedar chest, protector of woolens— appears to discourage them. Whether it is the securely closed box or the cedar smell is a matter of opinion. Newsprint, among papers, is not eaten because the wood fiber is not palatable.

Studies have produced the following recommendation for house-riddance of silverfish: Flour, 2 ounces; sugar, 2 ounces; warm water, 1 pint; barium fluosilicate, 2 ounces. Mix ingredients, add in the barium fluosilicate—a poison—last. Spread on cardboard, and, when dry, cut into convenient-sized pieces for distribution in dresser drawers, wardrobes and closets, bookcases and other places of storage, no matter how temporary. The flour and sugar offer a sweet but substantial dish; the barium fluosilicate kills. Powdered arsenic is also used in such card baits, and buhach powder may be sprinkled in their haunts. But with silverfish sight and sense of direction what they are, it is a gamble when they locate the bait. Libraries have tried fumigation; the Huntington Library has special vaults for its manuscript treasures.

At all events shake out garments that have been put away in drawers, dump the drawers before putting back. You may be "sure" there are no silverfish there, but if you watch carefully and quietly you may see a disturbed little creature, gray-bodied with pale yellowish antennae and legs, not more than three-quarters of an inch long. It is hardly noticeable as it seeks escape, running a little way, then stopping, and running again, its efficient antennae waving wildly.



The fastest horizontal flight speed of which there is authentic record has been recorded for the frigate bird.

How Fast Do Birds Fly?

By FRANK W. LANE

Illustrated by Olaus J. Murie

When the aviators came home after the first World War there appeared in a number of the world's bird journals accounts of the flyers' experiences with birds. Notable among these were the contributions made towards increasing our knowledge of the speeds at which birds can fly. Already the war just ended has produced a good crop of aviators' bird stories, and, as time goes on, there will no doubt be added to the ornithological records some further examples of airplane-speedometer-timed bird speeds.

There are a number of factors in the speed of birds that the bird lover, untrained in the lore of aerodynamics, may overlook. A fairly common error derives from the fact that a large number of speed records are based upon pacing by motor-car or motor-cycle. But such records, by themselves, are largely worthless from a scientific point of view, because speed on the ground and speed in the air are quite different.

What are the factors involved in timing the speed of birds? First there is the speed and direction of the wind at the height and in the immediate vicinity of the bird. Second one must consider the direction, including gain or loss of height, in which the bird to be timed is flying. Next is the distance covered by the bird during the test, and whether the bird keeps a fairly even pace throughout the course over which it is timed. Finally, there is the type of flight and the physical condition of the bird as it affects its flight.

Although interesting and, within limits, valuable records can be obtained without all these conditions being fulfilled, it is neglect of these factors that has been responsible for many of the apparently contradictory figures published in the past.

A brief explanation will show how misleading figures can be obtained when these conditions are ignored. A wind blowing in the same direction as a bird is flying virtually adds its own speed to that of the bird, and a contrary wind has the reverse effect. Hence bird speeds timed from the ground, whether paced by car, or timed over a course by stop-watch, are inaccurate unless accompanied by some information concerning the wind conditions at the altitude at which the bird being timed is flying. Broun and Goodwin, in their interesting paper in *Auk* for October, 1943, say of 167 birds timed over a course, that only *one* record was uncomplicated by wind factors and thus was of true air-speed. This was of a sharp-shinned hawk which, flapping continuously, traveled over the course at 34 m.p.h. During the same tests an osprey, with a *ground* speed of 80 m.p.h., was actually doing little more than "making use of a very strong thermal [rising current of warm air], so that the bird was in reality in steep diving flight without losing altitude."

Knowledge of the distance flown is an obvious necessity, and unless this is covered at a fairly even pace the result will show the average for two or more types of flying speed, and should be so recognized.

In 1900 an American pigeon flew 100 miles at the rate of 2511.87 yards—nearly a mile and a half—per minute.

Generally speaking, a bird has three types of flying speed — normal, accelerated or maximum (generally when chasing or being chased) and, in many cases, migration. A few other birds, for example the duck-hawk and golden eagle, sometimes also use the stoop or power-dive.

Even within the same species considerable differences of flying speed are noticeable. Age, state of plumage, health and other physical factors modify a bird's powers of flight. One member of a covey of partridges has been observed flying at least fifteen percent faster than the others when all the birds were in full panic flight before a falcon.

Ideally, therefore, any record that purports to represent the speed for any given species of bird under any one of the types of flying mentioned above should be for a bird in perfect condition.

Fortunately for students of birds' flying speeds there are one or two timing methods available in which all the conditions I have mentioned can be met. And in the case of timing by aeroplane nearly all the conditions are fulfilled. In my view, timing by aeroplane is the most satisfactory method yet devised for obtaining the flying speeds of birds that cannot well be timed by laboratory methods.

In France birds have been harnessed by silk thread to an indicator that recorded the amount of line taken out as the bird flew, and the time occupied. A simple calculation then gave the speed of the bird in miles per hour. The works of Marey, Houssay and Nagnan should be consulted for details of this method of timing.

Another indoor timing method, used in England to find the pace of a bird shortly after it has risen from the sportsman's feet, was particularly ingenious. In a covered range, where no wind complications would be met, birds were made to fly forty yards, and then to pass through two screens made of a very fine invisible cotton. The time taken was recorded by electrical chronograph (more accurate than a stopwatch!) and then the speed was worked out into miles per hour. By this method it was found that partridges and pheasants, just after being flushed, attain a speed of about 30 miles per hour, the heavier bird—the pheasant — being slightly the faster. Incidentally, there is a generalization that may be mentioned here: "The heavier the bird the slower it rises but the faster it flies."

When pigeons were timed by a similar apparatus, the speeds varied between twenty-six and thirty-four miles per hour. But in the case of all three species of birds I think it can be taken that the dis-

An aviator, diving, reported that a duck hawk shot by him as though the airplane were standing still.

One member of a covey of partridges has been observed flying at least 15 percent faster than the others when all birds were fleeing from a falcon.

tance flown before the testing distance was too short to enable maximum speed to be reached. For example, from the extensive speed records that have been compiled for the racing pigeon, it is known that some birds have maintained a speed of 80 miles per hour for half an hour or more, and although wind-factors may have helped, it is certain that an expert pigeon can fly considerably faster than thirty-four miles per hour on a completely windless day. In 1900 an American pigeon flew one hundred miles at the rate of 2,511.87 yards—nearly a mile and a half—per minute. I suspect it had a good following wind helping it along.

The golden eagle and the duck hawk, when nose-diving, probably travel faster than any other birds in the world. The eagle, being the heavier bird, probably attains the greater speed, although it is difficult to obtain reliable figures. The few pilots who have followed an eagle down give speeds in the region of 200 miles per hour, but it seems at times that even this great speed is exceeded. In fact the terminal velocity attained by a golden eagle after a stoop from an immense height (and they have been known to soar more than two miles high) must be colossal.

The highest record I have seen, and it is so high that I give it with some hesitation, is that of Seton Gordon, who is an expert on the golden eagle. He says he has known one to descend some 5000 feet in six seconds. And that works out at 570 miles per hour —the speed of a fighter plane in a power-dive, or the muzzle velocity of a revolver bullet! But it must be pointed out that even a slight error in either the estimated distance or the timing makes a considerable difference in the resulting figure. But even allowing for possible errors it would appear that this eagle certainly clocked more than 200 miles per hour during that headlong descent from more than a mile high.

For the duck hawk we have the experience of a pilot that gives a fair indication of the sort of speed these wonderful flyers can put forth when they are really in a hurry. The record is one of the most remarkable I have ever met in the whole literature of Nature speed facts. The incident appeared in *The Bulletin of the Essex County Ornithological Club*, and was recounted by Ralph Lawson from information supplied by the aviator in question, in whom Lawson had full confidence. This is the story:

"He [the aviator] was flying a small pursuit plane, which had a normal speed of about 125 miles per hour, and, while cruising about at a considerable altitude, he saw a bunch of ducks flying far below and ahead of him. Thinking to gain some experience in diving at a moving object, he turned the nose of his plane down and opened the throttle of his engine, thereby gaining speed rapidly. While he was still some distance from the ducks he glanced at the wingtip of his plane to see how much vibration his swoop was causing, and as he did so a hawk shot by him 'as though the plane was standing still', and struck one of the ducks, which fell towards the ground apparently lifeless. At the time the hawk passed the plane the latter was traveling at a speed of nearly 175 miles per hour, and my friend thinks that the hawk was stooping two feet to his one, but of course that is only an estimate, as under the conditions no accurate computation was possible. We do know, however, that this particular hawk was moving at a rate of speed much greater than 175 miles per hour and perhaps not far from double that rate."

In support of this statement regarding the tremendous speed of this most spectacular bird there is the experience of the Scottish writer on wildlife, H. Mortimer Batten. Batten tells how, when he was living on the shores of Loch Ken in Scotland "a peregrine [called in America the duck hawk] used occasionally to come hurtling down the face of the Bennan for a matter of 1000 feet or so, in order to put the breeze up the wildfowl feeding on the loch. I never saw him strike at them, but, as his headlong descent down the mountain terminated, he would cork-screw clean across the loch by sheer inertia, literally revolving at giddy speed for the space of over a mile. It was, of course, difficult to judge, but it certainly seemed that he covered that mile over the water in the space of about ten seconds!" This would be about the highest (Continued on page 165)

A year or so ago Pearl Joan Cosgrave sent us a poem. It was published, but somewhere in the complicated business of preparing the annual index Cosgrave was transformed in Cosgrove. Whereupon Miss Cosgrave properly took us to task, at the same time submitting the article below. We found it most interesting, especially for the considerable contribution that Nature has made to our English surnames.

Surnames and Nature

By PEARL JOAN COSGRAVE

MR. TODD and Mr. Lawrie are walking down the street. They see Mr. Fuchs and Mr. Renard coming toward them.

If such a statement seems to invite the popular "So what?" let us put it in a different way.

Mr. Fox and Mr. Fox are walking down the street. They see Mr. Fox and Mr. Fox coming toward them.

Both statements say the same thing. The first, however, indicates that Mr. Todd's paternal ancestors probably lived in northern England several centuries ago, when surnames came into being; that Mr. Lawrie's people lived in Scotland; the forebears of Mr. Fuchs in Germany. Mr. Renard's forefathers were French.

Let us not jump to conclusions. Today all Todds, Lawries, Fuchs and Renards are not necessarily of British, German, or French origin. Todd, for instance, *could* also mean a Holland fishing boat. Also, people are sometimes dissatisfied with their own names and wish legally to change them.

Considering the word "surname" itself, the first part, *sur*, means upon, above, on top of. "Last" names were placed *on top of* "first" names about eight or nine centuries ago to distinguish the various Toms, Dicks, and Harrys of that day, one from the other.

Surnames originated as the simple result of necessity. Population groups were increasing. Commerce was spreading. Rural areas were becoming villages. Villages were growing into towns. When Tom, Dick, and Harry moved from one place to another they needed some means of identifying themselves from resident Toms, Dicks, and Harrys.

In England these family names did not become hereditary until after the Norman Conquest. Previously, they scarcely existed. Once in a while some important person came down in history with a nickname, such as Edmund Ironside. This was exceptional.

During the eleventh and twelfth centuries a change took place among all the more populated and civilized European societies. Man's new and distinguishing *last name* became part of his property. It passed on to his direct descendants with his other possessions.

There are various ways in which surnames originated. Sometimes they designated property owned. At other times they were assumed by, or applied to, an individual as the result of some local peculiarity or distinguishing feature marking his place of residence. Nature generously furnished sources for many of today's popular surnames. Not only geographic and topographic features, but, also, natural resources, trees, and plants came in for their share of name-giving. Birds and animals contributed to the nickname group.

There are a few other classes. The occupative group includes those derived from occupations. And, since it is natural that young people be known as the children of their parents, patronymic surnames arose. Other names were derived from personal names.

A large number of our most common surnames today are occupative. This is not surprising when we consider the fact that the same craft often persisted in one family for several generations. It is believed that occupative surnames were probably the first to become hereditary.

For example, let us suppose that three men, all named Tom, lived in one community. One was a baker; another was a miller; the third was a smith. To avoid confusion, people of the community would speak of the first as Tom, the baker. The second would be known as Tom, the miller; the third, Tom, the smith. Nothing could be more natural then, than for these men to become Mr. Tom Baker, Mr. Tom Miller, and Mr. Tom Smith.

Now let us further suppose that two Toms, two Dicks, and two Harrys left London at the same time for Liverpool. Both of the Toms were bakers. Since there was already a Mr. Tom Baker living in Liverpool—our hypothetical community of the preceding paragraph may as well be Liverpool—the people of Liverpool would now have the problem of distinguishing between the three bakers, all named Tom. The first Liverpool Tom would continue to be known

as Mr. Tom Baker. One of the two London Toms might easily become Mr. Tom London. If the other Tom-from-London was extremely tall and slim he might become known as Mr. Tom Long—or Longfellow. Long and Longfellow belong to the nickname group of surnames.

One of the two Dicks from London might also be a baker. If his neighbors considered him extremely shrewd or cunning, he could easily become Mr. Dick Fox. If the other Dick-from-London were *also* a baker he could be named Mr. Dick Baker—provided that the Liverpool Dicks were not bakers, and the new name would not be confusing. These same things could happen to the Harrys.

There *could* be still another baker in Liverpool. We shall call this one Matthew. If our second Harry-from-London became associated with Matthew in the baking business he might become Mr. Harry Matthew. His surname would thus be derived from a personal name.

On the other hand, this Harry might wish to be known as the son of his father who was called John, or Andrew perhaps. Harry could then be Mr. Harry Johns, Mr. Harry Johnson, or Mr. Harry Andrews. In southern England the genitive *-s* was more common. In the northern part of the country *-son* was frequent. The Scandinavian countries contributed *-sen*. Children whose fathers had died often assumed their mother's name. Thus, Bett and Betz are usually from Elizabeth.

Among the most popular prefixes and suffixes showing this patronymic relationship are *O'*, *Mc*, *Mac*, *Fitz*, *Ap-*, *-fils*, *-of*, and so on.

Harry, however, may have settled down near a brook running through a meadow. In such a case he might easily become Mr. Harry Brookman, or Brookover, Brookley, or something still different. Lee, or lea, a meadow land, appears today in such other forms as Leigh, Leighton, Brownlee, Crowley, Cowley, Bradley, and so on. Bartley means a barley field; Harley is hare lee.

The name Burns is for a brook or little stream. Beck, usually an occupative surname for bake, is sometimes for brook, and is then a local or place name. Another form is Bach.

Etymologically, every family name is a nickname; that is, an "eke-name," intended to give auxiliary information that helps in identifying the bearer. These nicknames were first conferred on one because of some characteristic feature, either physical or moral, or because of some adjunct—often trifling—with which one's personality was associated. William of Orange is said to have remarked, when he lost the tip of his nose to the sword of a Saracen giant, that even though his nose was a little shortened, he knew well that his name would be thereby lengthened. So *Guillaume d'Orange*, with his *court nez*, or *short nose*, has given us Courtney, or Courtnay.

The greatest number of nicknames were taken from the names of animals, such as Fox; and from adjectives, either alone or accompanied by a noun, such as Long or Longfellow.

Martin is sometimes from the animal, the marten. However, it may be a personal name from Martin. Other popular names of today are derived from such personal names as Adam, Thomas, Peter, and many others.

The present-day spelling of a name *may* be purely accidental. In England alone, until the latter half of the nineteenth century, a large proportion of the population did not spell their names at all. The parson and clerk were entrusted with the responsibility of recording these names when necessary, and they did their best with unfamiliar ones. We can easily understand why the same name might be spelled in more ways than one. Even today, especially in our rural districts, we may find half a dozen or so orthographic variants of a name among the few documentary records of an individual's life. Much of this early spelling was roughly phonetic. It was an attempt to reproduce the sound of a period and of a region.

America, "the melting pot," has anglicized, in whole or in part, a vast number of foreign names. Sometimes this is deliberate; sometimes the result of confusion. Probably more than one Johnson—the son of John—was originally a Scandinavian Jensen, or a Russian Ivanof. Likewise, all the Lees may not be from Nature's meadows. In some instances they come from Levy, or Lewis, or perhaps some other source.

Another present day orthographic confusion is concerned with Grove and Grave, which come from different sources and should not be interchanged. Grove is a place name. Grave is usually occupative or official.

If a surname happens to be the name of a country, county, town, or village it was usually acquired when the locality was left, as in the case of our imaginative Mr. Tom London who left London and went to Liverpool. Small features of the landscape, such as bridge, or hill, gave us surnames derived from one's place of residence. These local, or place, surnames may range in origin from a country to a plant.

The points of the compass are today disguised in Norris, Sotheran, Easterling, and so forth. However, Norris may sometimes be occupative, from nurse.

Some of our most popular names derived from

places include Moore, Scott, Hall, Wood, Green. Variants of Moore include the Scotch Muir. In combinations we find Whitmore and Densmore. Moor, however, may be official.

Dean meant a glade or valley in the wood. Today we find Deahn, Dryden, Bradden, Snowden, Denner, Denman, Borden, Cowden, and Gordon. A Gore was a triangular bit of land. Kerr and Carr are forms for marshy land—for Marsh. Whitmarsh is popular. We also have Heath.

A small wood was called Strode or Straud. People living about such a region acquired the names of Atwood, Woodside, Underwood, Westwood and the French Dubois, to mention a few.

The Forester who looked after the Forest was also called the Woodward. This occupation appears in Woodworth, and Foster. Walker may refer to a Forester, or it may refer to one who, like the Fuller and Tucker, did work in the manufacture of cloth; a cloth-fuller. The Walkers who were Foresters were assigned by the King, and were *walkers* within a certain space of ground assigned to their care.

In the northern part of England Shaw was almost as common a word as wood itself. Holt was popular in the east and south. A broad shaw gave us Bradshaw. We also have Belshaw.

A Slade was an opening in the wood. From Hedge and Hedges we have Hayes, Haynes, Haw and Hawes, Hay and Hayden, and others.

Field is another source of many present day names. These include Brownfield, Whitfield, Greenfield, Beauchamp and Fairfield. The Fielder usually had several fields under his care.

A hollow in the hills was called a Combe; sometimes Comb, Duncombe, or Whitcomb. Living on a hill, or Downs, were people who took such names as Hiller, Hillman, Hills, Hille, Hull, Hult, Hillyer, Hillier; and Dunn, Dunne, Downes, Downs and Langdon. A large hill offered Beaumont, Radcliff, Craig, Mounts, and so on. A man living at the top might be called a Peaker, Peck, Peach, Pick, or Picker. Other names of this kind include Clough, Dale, Dell, Dales, Vail, Glenn, and Glynn.

In addition to the oak, with Oaks, Oakley, and Braddock, other trees have given us surnames. We may include Ogden, Pine, Nash, Ashton, Ashley, Ash, Ashby, Ashe, Ashford, Ashworth, and Ashlock. The Beech tree has become Buck or Buckley, Beach and Beechner. There is also Maple, Mapes, Elms, Deselms. The tree Stump has varied to Stocks, or Stamp.

At one time Holly was called hollin. This became Holm, and then Holmes, Holms, Holling, Hollingshead, and Hollis. Holm sometimes means a river island. Chisholm is a pebble beach. Hawley means hedge lee.

Barnes may be what it seems but more often it probably comes from the Scotch *bairn*, meaning child. A well has given us Wells, Weller, Wellman, Caldwell, and Colwell. Dyke gives Updike, or Foss; sometimes Waugh.

The various shops and taverns of a few centuries ago were not numbered as they are today. Instead, they had signs. Common shop signs included those of the Peacock, Swan, Swallow; or Bell. Bell may also come from residence near the church or town hall; it may mean beautiful.

Chase was used for a park. Streets have become Streeter, LaRue, Via, Way, Lane, and Longstreet. Lynch, a boundary, is about the same as golf-*links*.

A Bridger had something to do with a Bridge. Fords and Fordes were frequent. Today we find Bradford, Whitford, Langford, and other combinations.

There are Banks and Rivers as well as the Lake, Shore, and Beaurivage. Pond, a doublet of Pound, means a piece of water; it was usually enclosed by a dam. We also have such names as Pool and Spring.

Such names as King, Earl, Bishop, Pope and Kaiser were often conferred on performers in religious plays, or were acquired in connection with popular festivals and processions. Names were derived from civil honors, dignities, and rank, as well as from King, Duke, Prince, Lord, Baron, Knight, and such.

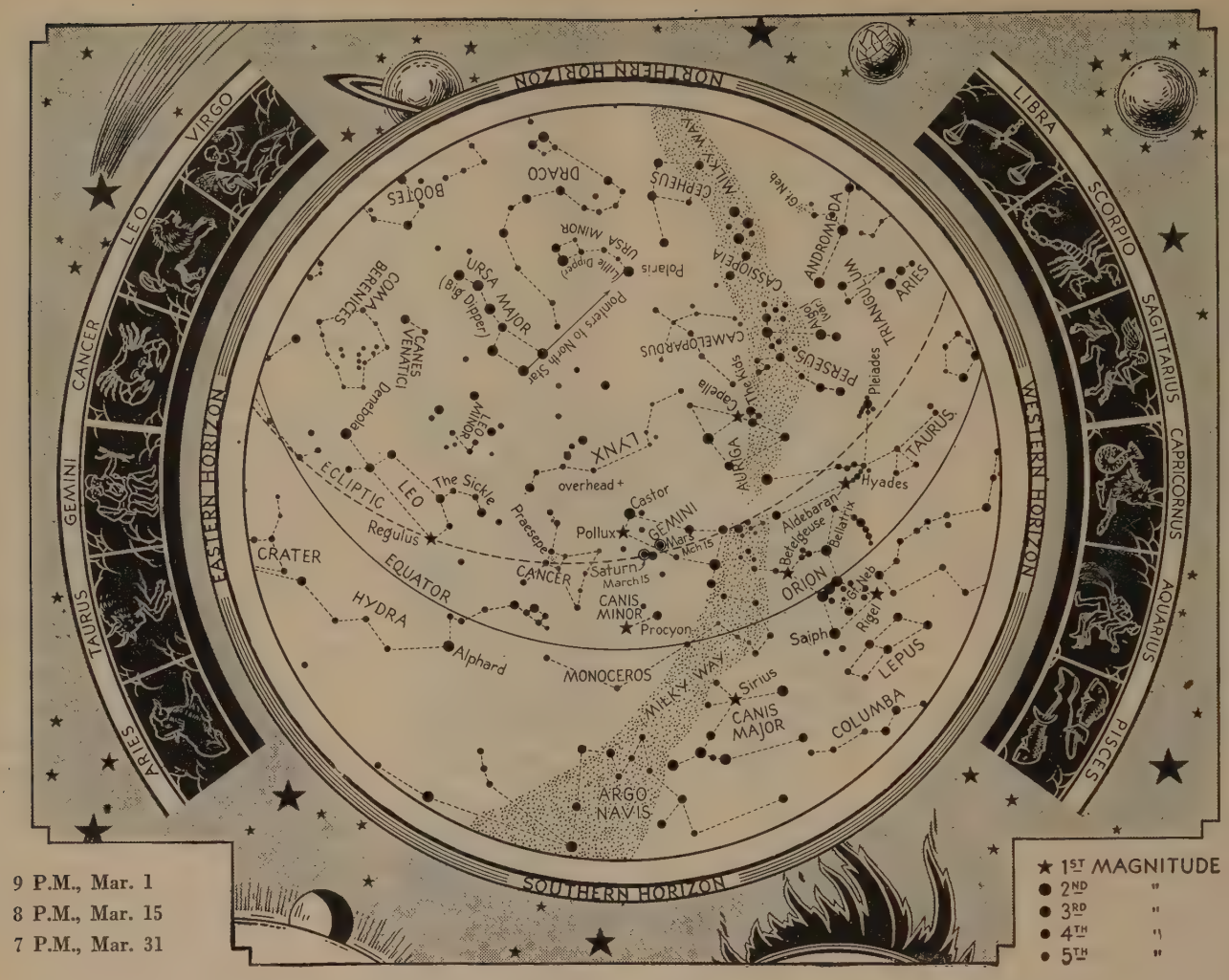
From Griffin, that fabulous animal supposed to be part lion and part eagle, comes Griffis, Griffith, and Griffitts. Drake may mean dragon, instead of the bird. We also have Teal, Teale, and Teel.

Other popular animal names include Best for beast; Fisk for fish; Katt, Lamb, and Wolfe. We may also include Hart, Harte, and also Beaver.

Ray is usually from roe; the Peacock was once the Poe, and Pay is another form of the word. Coe is an old name for jackdaw, but may also stand for cow.

Salmons or Salmon are from Salomon and Solomon rather than from the fish. From the Anglo-Saxon personal name of Sparrow-hawk, we now have Spark and Sparks.

One more word of warning. While a great hunter could be called Grosvenor, Codlin had nothing to do with a young cod fish; nor does it mean to coddle. Codlin comes to us by way of such names as Quodling, Querdling, and Querdelyown, from the French *Coeur de lion*. Codlin means lion-hearted.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

Mysteries of Mars

By ISABEL M. LEWIS

THE ruddy planet Mars was nearest to the earth in January, although then nearly 60,000,000 miles away and at one of its least favorable oppositions. This nearness is compared with less than 35,000,000 miles at the closest approach of Mars in 1924. The planet is now rapidly increasing its distance from us. On March 1 it will be at a distance of about 82,000,000 miles, which will increase to nearly 107,000,000 miles by the end of the month.

Of all the members of the solar system Mars appears to arouse the greatest popular interest, with the possible exception of our satellite the Moon. This undoubtedly can be attributed to the fact that Mars' surface changes, which are varied and many, are such as to suggest the possibility of life in various forms upon this neighboring world.

The Martian day differs little in length from our own. The inclination of the planet's axis of rotation to its orbit is such as to produce seasons very similar to our own, although nearly twice as long, since the Martian year is nearly twice as long as our year. These are facts that indicate a certain resemblance between conditions existing on this far world and on our own, although there are many striking differences. Mars, like the earth, has white polar caps that change in appearance with the seasons. Martian polar caps, however, show the scarcity of water upon the planet, for they often melt completely away by mid-summer. The snow cannot be more than a few feet deep at most, while terrestrial polar caps are hundreds of feet deep and are an indication of the abundance of ice, snow, and glacial deposits upon a world that is three-fourths covered with oceans and seas.

Although the diameter of Mars is only a little more than half that of the earth, and its surface area about one-fourth the earth's, its land area is about equal to

that of our own planet. There are no extensive bodies of water on Mars although there may be some marshes, swamps and lakes, and there are known to be, at times, extensive areas in which familiar surface features are temporarily obliterated by fogs, mists or clouds. Most interesting and puzzling of all Martian features are the Martian canals, meaning not canals in the terrestrial sense of narrow, artificial water-ways. Such would, of course, be invisible at our distance from the planet, but the canals on Mars are vegetational strips bordering on water-ways, generally ten to twenty miles or more in width. Schiaparelli, in 1877, first announced the discovery of a fine network of lines, to which he gave the name of *canali*. These crossed, in all directions, the reddish-ochre desert regions of the planet, which cover more than half of the surface. His findings were confirmed by the observations of Lowell and W. H. Pickering. It was found that some of the canals became double at times; that a number of them met in dark spots, 50 to 100 miles in diameter. These were named "oases," and they also crossed the dark areas in tropical regions, as well as the desert regions lying chiefly in the temperate zones.

The dark areas on the surface of the planet are mostly in tropical regions, but extend into the southern hemisphere. They form a sort of dark belt around the planet, of which the most conspicuous feature is the Syrtis Major, a marking that resembles in shape and size the peninsula of India on our own planet. The Martian equator passes through it. To the south of the Syrtis Major stretches a region which, as well as other dark regions, turns green with the melting of the south polar cap. Beyond it, in the direction of the pole, lies a reddish, elliptical-shaped area known as Hellas, extending to within ten degrees of the planet's antarctic circle. During the Martian winter the south polar cap extends so far north as to include most of this reddish area. As the southern hemisphere of Mars has been tipped toward the earth at nearest approach of the planet in many years, this is one of the most observed regions of Mars.

At the opposition of 1939 the planet was only a little more than 38,000,000 miles from the earth, but, because of its far southern position, it could not be seen to advantage in the northern hemisphere, although it would be in an exceptionally fine position for observation in the southern hemisphere. The Lowell Observatory at Flagstaff, Arizona, which has specialized, since its founding in 1894, in observations of the surface features of the planets and, in particular, Mars, decided to send an observer to the southern hemisphere to make visual and photographic observations of the planet. Dr. E. C. Slipher, Director of the Lowell Observatory, made the trip, which turned out to be most fruitful of results. At the Lamont-Hussey Observatory at Bloemfontein, Africa, the 27-inch refractor of the observatory was placed at his disposal. Between June 24 and August 27 observations were possible on seven-eighths of the nights, and about 250 plates and 8000 images of Mars were obtained. Two special cameras had been constructed at Flagstaff, one for making photographs in blue light, the other for photography in red, yellow and green light, thus providing a wide range.

Conditions were favorable for obtaining excellent observations, and Mars itself, photographed near midnight and almost in the zenith, rose to the occasion and displayed remarkable changes and developments in surface features in unusually great numbers. Photographs of the canals were obtained, confirming their existence as revealed, also, by previous photographs. Many features of the planet's surface that had never been seen before were displayed. During the period of the observations the Martian season corresponded to our April and May. The southern polar cap was seen to decrease from nearly its maximum size, recede toward the pole, and develop as in previous apparitions, dark rifts as some portions melted more rapidly than others. Observations were also made of the north polar region. Color photographs showed that the red heat rays penetrated the canopy of haze above this region, and, with other observed facts, indicated that it consisted of fog or fine ice particles. Many remarkable changes were observable in familiar dark regions near the equator, in addition to the usual seasonal changes..

Portions of well-known features faded or disappeared, while new dark markings of great extent developed. The most remarkable of these dark markings covered an area of about half a million square miles. This same feature appeared, faintly, fifteen years earlier in photographs made at Flagstaff, but was not recorded earlier than 1924, and appeared to be a new, strongly-developing marking. Pickering explained the appearance of such markings as due to the flooding of swampy areas, but Slipher, writing of these observations in *The Telescope* for Sept.-Oct., 1940, thought it unlikely that Mars possesses enough water for such a purpose, especially because of the great size of the marking and because of its appearance in an area that has always been considered to be a desert. Faint appearance in 1924 would indicate a slow development (Continued on page 160)

Mountain Drive

By ELINOR HENRY BROWN

At sunset we would cross the pass—
But there was no sun that day.
Great drops slid down the windshield glass
While the slow miles droned away.
At sunset we were crossing the pass—
A rainbow bridged our way.
Rose light flashed on the windshield glass
As the swift miles dropped away.

The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

OBJECTIVE: IMPROVED CONSERVATION TEACHING

THE National Research Council tells us that in the next decade the minimal demand for technically trained leaders in the field of agricultural science will be approximately two and one-half times the normal pre-war supply. When we take into consideration the lag necessarily created by the war, and the five to seven years of training considered necessary beyond high school, it is obvious that the next few years are likely to be critical in setting the pattern for leadership in the important field of conservation education. We do not, today, have specific figures that represent the situation in conservation education, but all information we do have indicates that the situation is likely to be even more critical in conservation education than is probable in the general field of agricultural science.

We have lived through a period in which conservation has been far from the order of the day. We have gone all out for this, that, and the other thing, letting the devil take the consequences. Apparently the devil has not passed up the opportunity. We have spent, and spent, and spent. We have built only to destroy. We have taken desperately wherever opportunity presented itself, and we have killed whole flocks of geese capable of laying solid golden eggs. It is perfectly obvious that we cannot continue indefinitely in this direction, and that something must be done about it. The teachers must assume some responsibility to bring about this change.

The present situation is complicated by the overtaxing of training facilities in the established educational centers. Why we cannot build homes for returning veterans equal at least to those we built for laborers who stayed safely at home is hard to see. And why we are rationing graduate students when the demand for their training is essential to a rational national policy can be understood only with great difficulty. We cannot forget that in Russia, in spite of the war, the quota of trained leaders has been increased. Neither can we forget that in the United States the leadership in one of our important technical fields dropped during the war to 10 percent of the prewar level, while Canada maintained its production in that field through the conflict. We cannot afford for one minute to overlook these points.

We must, and will, provide, to some extent at least, for the improvement of returning veterans. They should be given certain priorities where they have demonstrated ability to profit by the experience, but we have no right to ignore the generation that was too young to enter the armed forces. We cannot honor requests such as came from one veteran who said that he wanted to be a lawyer, and that, because of his war service, it was up to the government to make him a lawyer. Yet an examination of his record indicated that he had little possibility of attaining professional success in that field. We should not try to make silk purses of sow's ears, even though we can make "silk" stockings from pine lumber.

But what has this to do with conservation? One state, which before the war had no department concerned with conservation education, next year will have a staff of ten working in that field, and with generous financial support. Can we afford to fill these positions through personal or political preference? And if, under the stress of circumstances, we find ourselves forced to engage partially-trained workers, what must we do to correct the situation? We must keep the long-time training program in mind and functioning, but we must also do everything we can to improve the service of those who may be actively engaged in educational endeavors.

It is encouraging that, with the release of some travel restrictions, to the extent that you can travel if you can find a seat, we are taking seriously the holding of meetings designed to improve professional service.

For more than ten years the American Nature Association has sponsored fellowships that have helped in the training of leaders now actively engaged from coast to coast. Other organizations have done likewise, and meetings are being held that should improve conservation leadership. Within the last year, The National Audubon Society joined with other organizations in the formation of a Conservation Council designed to integrate the efforts of many groups. Even more recently, the Izaak Walton League has organized a special conservation education committee that has held two meetings preliminary to a general program to be held in Chicago March 28. The Soil Conservation Service has been holding regional meetings designed to improve the educational service of this government agency, to the end that what is known about soil conservation may be put to use widely. In Ohio, a conference was held in late December to formulate a policy for that strategic state, and to try to integrate the rather many agencies working there towards a more or less common goal. In Wisconsin, one of the teachers colleges now offers a full, four-year program for those wishing to enter educational work with conservation as a major interest. And so the story goes.

Possibly one of the more important meetings will be the annual meeting of the North American Wildlife Conference to be held in New York, March 11 to 13. It is understood that one session of this meeting will be set aside for educational problems and their solution. Unfortunately, such meetings as the New York meeting just suggested will be attended by few teachers who will be actively engaged in teaching in the schools the day after the conference closes. Whatever may be decided at the American Wildlife Conference may eventually get into practice in the schools, but it is not likely to be felt immediately. As this article is written we have news that the American Wildlife Institute has just established a fellowship for the study of the qualities that go into the production of superior leadership in wildlife conservation fields. All of this is essential to the eventual solution of the many problems that exist. All should be encouraged.

However, there is one meeting, to be held in St. Louis on March 30, that deserves wide publicity. The place is geographically central; the meeting is held on Saturday. It is held during, and in cooperation with, the meetings of the American Association for the Advancement of Science. And it will bring together in one place, and at one time, those who are in position to know best what all the other units may have in mind doing. The meeting is the annual meeting of the National Association of Biology Teachers, an organization whose membership is largely from those actively engaged in the teaching of biology at the secondary level. At least a part of the meetings will be held jointly with the National Science Teachers Association and the American Nature Study Society, but the main

effort will lie in integrating the work of the major groups interested in conservation education. The program for the day will include the following speakers:

Dr. A. J. Carlson, University of Chicago, on Science in Education; Fairfield Osborn, New York Zoological Society, on International Significance of Conservation Education; Dr. Edward H. Graham, Chief Biologist, Soil Conservation Service, on Soil Conservation and Biology Teaching; Dr. L. B. Sharp, Life Camps, on Contribution of Organized Camping to Conservation Education; Dr. Ira N. Gabrielson, Chief of Fish and Wildlife Service, on Value of Wildlife Interests to Teaching of Biology; John H. Baker, National Audubon Society, on that Society's contribution to conservation education; Clayton Seagears, Conservation Education Superintendent for New York State, on possible contributions of state departments; Betty Lockwood, Harvard University, on Importance of Health Education in Conservation of Human Resources; Dr. John W. Scott, Izaak Walton League, on plans of that organization for a national conservation education program.

One or more other speakers may also have places on the program, but it seems rather doubtful that a more representative and influential group of leaders in conservation education has often met before with a group of teachers—teachers who will be prepared to put into action the following week what they hear at this meeting. We hope that we may see you there.

Longleaf Pine

Longleaf Pine. By W. G. Wahlenberg. Washington, D. C. 1946. The Charles Lathrop Pack Forestry Foundation. 429 pages. $5.00.

It is doubtful that any other species of tree has received such comprehensive treatment as has the longleaf pine within the covers of this book. The author is one of the leading authorities in the United States on the sylviculture and management of the principal pine types of the South. In bulletins and articles he has written widely in this field, and foresters, and others interested in longleaf pines are indebted to The Charles Lathrop Pack Forestry Foundation and the U. S. Forest Service for bringing the material together in this inclusive volume. The book is divided into five major sections: Resources, Uses and Properties of Longleaf Pine; Ecology; Regeneration; Protection; Management. Appendices cover a wide variety of valuable information and there is an excellent bibliography and index. Forty-eight excellent plates illustrate the subject. This book, indeed, sets a high standard for any other future publication dealing with a single forest species of economic significance.

R. W. W.

SUBURBAN BUTTERFLY

By ELEANOR SCOVEL MILLER

It was a warm day in August, and I had shut the office door with a sigh of relief and made for the shady side of the street to go to Suburban Station in Philadelphia. I reached the lower level, and was about to enter the train going to my suburban home, when a butterfly fluttered toward me and alighted on my jacket pocket, just over my heart. It was one of the rust brown varieties with black spots.

I sat down and opened my newspaper. The conductor collected tickets, and I expected my butterfly to flutter off at any moment, but it did not. It rode the entire distance to Chestnut Hill station (a matter of thirty minutes), and did not seem the least disturbed by the noise and flutter of my newspaper.

When we reached the station, the last one on the line, I arose and the butterfly fluttered to my shoulder and stayed there, waving its wings. When I reached the grass and shrubbery surrounding the station, I gave it a light brush-off and it fluttered away, alighting on a bush.

On the trip I noticed people looking at the butterfly perched on my shoulder, and naturally felt somewhat self-conscious. After all, there are not many ladies of fifty sporting live shoulder butterflies. How it got into an underground, city, railroad station is an unanswered question. Possibly it had come to town on a bouquet of garden flowers brought in by a suburbanite. At any rate I was impressed with the perfect aplomb displayed by the butterfly in its ride back to its natural habitat.

Samples of Wood

Allen G. Miller of Kalmia, North Carolina, has made a hobby of collecting and finishing up samples of wood from his part of the country. He writes us that he has quite a few sets that he feels would be of interest to schools, in particular, and he would be glad to supply these merely for the cost of mailing the specimens. He suggests that people interested might indicate a half-dozen or dozen samples of local wood they would like to have. Since it is impossible to say in advance what the mailing would cost, we would suggest a postcard correspondence with Mr. Miller, indicating the extent of one's interest and the purpose for which the specimens would be used.

ANSWERS TO WEATHER QUIZ

1. g, 2. , 3. l, 4. i, 5. c, 6. o, 7. n, 8. d, 9. f, 10. k, 11. b, 12. e, 13. m, 14. j, 15. h.

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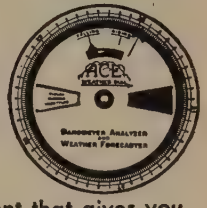

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EARTH'S MOST AWFUL BLAST

(Continued from page 124)

across the narrows. Parasites clung to their bodies.

Man brought rats. They appeared on Krakatoa in 1917, having arrived aboard a boat carrying visitors to the island.

Plants and animals came over by accident, but there was nothing accidental about the sequence in which they established themselves. It was a rigid chronological pattern telescoping millennia into months. Some forms of life had to be there first so that others could live. Birds may have rested on Krakatoa a few years after the eruption, but they could not stay, since there were no fruits, seeds or insects.

For a while some forms prospered enormously through the absence of enemies and competitors. Around 1910, Krakatoa was overrun by swarms of ants; ten years later, when there were plenty of birds and reptiles, the ants had all but disappeared. The first few grass blades soon grew into a field that covered the whole island except its perpendicular cliffs. But by 1919 the first small clusters of trees had taken root, and by 1924 they had grown into a continuous forest. A few years later, climbing plants were already choking the trees to death and transforming the new forest into a tropical jungle complete with orchids, butterflies, snakes, and numberless birds and bats, and with a small lake.

Krakatoa became a naturalist's paradise; the Dutch made it a Nature reserve and allowed no one but accredited scientists to set foot on the island. The naturalists worked out a complete inventory of life on Krakatoa. They counted the steadily growing number of new arrivals and observed how they lived with each other and fought each other.

Then, one day, the scientists discovered that still another sort of life was stirring on Krakatoa—life in the earth itself.

The old volcano was not dead.

Deep down under its rocky foundations a pocket of lava was seeking an outlet for its energies. The bottom of the inland sea was heaving and buckling again. A submarine cone was building up; on January 26, 1928, it broke the surface and showed its top, a flat, ugly island a few hundred feet across, which the waves washed away a few days later.

A year passed. Then, suddenly, not far from the place where Danan and Perboewatan had first appeared, a geyser began to spout steam and ashes. Sulphurous fumes were drifting over the ocean. Again the sea was covered with dead fish floating belly-up.

The scientists measured the temperature of the water a hundred yards from the geyser. It was 30° F. warmer than the surrounding sea.

The new geyser is still there. Its identity has been established; it is a portion of the ancient crater rim with mud deposited on its top and flanks and a flue in its center—a safety valve for the stupendous pressure generated by the lava pocket underneath. The natives call the new volcano "Anak Krakatoa," the "Child of Krakatoa." No name could be more ominous.

THE WAR AND PACIFIC BIRDS

(Continued from page page 127)

The birds had come there in April, dug their burrows, laid their eggs, hatched them and raised their young to nearly full size while bombing was going on a few yards away.

When, in 1891, I visited Sand Island, of Midway, it had been bared of birds by shipwrecked seamen. It was again robbed of its birds in 1903 by plume hunters. Now it has birds by tens or even hundreds of thousands. The Commercial Pacific Cable Company had kept vermin off the island for many years. Surely, even with the devastation by the war, the extra good care that we hope will materialize after the war will build up the flocks even to saturation point. It is fortunate that Captain Gordon Rowe, another bird lover, has succeeded Gail Morgan at Midway. He will carry on the good work with wildlife.

War's spreading of people over islands of the Pacific has stimulated interest in the sea and land birds of this area. To help satisfy this interest several books on these birds have been published. These include *Birds of the Southwest Pacific,* by Ernst Mayr; *Birds of the Middle Pacific* and *Wings over Midway* by Thomas M. Blackman; *Birds of Hawaii,* by George C. Munro. It is hoped that these works will renew or stimulate an interest in the protection and study of these birds. The effect of war will need to be studied thoroughly, and measures should be taken to make up for losses and prevent further losses. We know that cats and rats have established themselves on some islands, and may be on others not yet studied. We know too little of the life histories of the birds of the middle, southwest and north Pacific, and encouragement of local students is necessary. Occasional expeditions and surveys serve a purpose but do not acquire all the information necessary. The Honolulu Audubon Society is taking up some of this work of bird protection and ornithological research. This is being done, in a modest way, by contact with naval bases and residents of other islands. Wherever possible it will carry on bird banding and other studies of bird life.

MYSTERIES OF MARS

(Continued from page 157)

of this remarkable new feature. The mysterious fading away of portions of familiar features, mentioned above, is apparently the reverse of the other changes, and was believed by Slipher to last too long to be attributable to transitory haze over so great an area. It appeared to be a real fading away of some dark coloration. Another remarkable, and also unexplainable, Martian feature is the fading out of certain well-known canals, with coincidental strengthening of other canals emanating from the same oasis. This phenomenon has been frequently observed, as has the fading of familiar and long established markings. These are but a few of the mysteries presented to us by the strange happenings that are evidently taking place on the surface of our little neighbor in space.

Mars will be found this month in Gemini, ranking in brightness with the first magnitude stars near it. Saturn is also in Gemini this month. Nearly equal to Capella in brightness, it will be slightly brighter than Mars by the end of the month, and easily distinguished from it by its pale yellow color. The two planets will be in conjunction on the evening of March 18, Mars passing about three degrees north of Saturn. Jupiter is now in Virgo, a little to the northeast of Spica, and rises late in the evening. Venus is now low in the west and cannot be seen to advantage this month. It will be in conjunction with Mercury on March 18, when Mercury will pass five degrees north of Venus. Mercury will be in conjunction with the sun on March 26, and at greatest eastern elongation on March 9th. It should be visible in the evening twilight for a week or more before and after this date. This is the best time of year to observe Mercury in the evening sky, and before rather than after the elongation. It will set more than an hour after the sun. On March 21, 12:33 A.M., Eastern Standard Time, the sun will cross the equator coming north, and spring will begin in the northern hemisphere.

Colombia Conservation

Action and legislation to conserve forests, soil and scenic areas were asked by the first Forestry Congress held recently in Bogota, Colombia. Appropriations were requested to launch a program of public education as to the value of forests and their relation to soil erosion. Government scholarships for the training of forestry specialists were urged.

Cornell Leaflet

"Window Laboratories" is the title of the most recent Cornell Rural School leaflet to come to hand. It is a collaboration by Gustave B. Timmel and E. L. Palmer, and explores and explains the possibilities of what may be studied and learned at the schoolroom window sill.

Bamboo Possibilities

About fifty years ago Government plant explorers began bringing in bamboos from the Orient and other parts of the world. There are now many small plantings of good varieties on farms in the South, and B. Y. Morrison of the U. S. Department of Agriculture Plant Industry Station at Beltsville, Maryland, says that farmers may well regret not having made more extensive plantings. Recent experiments indicate good possibilities for bamboo in the manufacture of paper and better quality composition board. Commercial success in these researches will put the growing of bamboo in this big business class, it is believed.

Conservation Contest

The Conservation Forum of Buffalo and Western New York, organized in 1939 and now supported by more than thirty affiliated organizations, announces its 4th annual Junior Contests as follows: Open to schools throughout western New York (7th and 8th Judicial Districts). Entries received up to April 13, 1946. No entry fee. Awards will be made for (a) *Conservation posters*, (b) *Conservation essays*, (c) *Reports* of conservation projects, individual or group. Full information and contest rules will be forwarded on request. Address the Education Chairman of the Forum, Miss Gertrude G. Webster, 120 Minnesota Ave., Buffalo 14, N. Y.

Outdoor Manners

To *The Ohio Conservation Bulletin* Joseph C. Goodman of Columbus reports discovering two rustic signs bearing pointed quatrains composed by someone thoroughly disgusted with the outdoor manners of many Americans. These stanzas might will be burned on a slab of wood by other property owners, and prominently posted. One reads:

"Who picnics by the roaring waves
And all the front with litter paves—
May indigestion rack his chest
And ants invade his pants and vest."

The other quatrain is in much the same vein and says:

"Who throws his rubbish on the land
And litter sheds on every hand,
May his back axle let him down
On a road ten miles from any town."

Garden Institute

Having done a notable job of urging millions of Americans to grow Victory Gardens, the National Victory Garden Institute is not laying down the hoe and weeder. Its officers and trustees have voted that, victory having been attained, it will shorten its name to National Garden Institute, broaden its activities, and go right along whooping it up for gardening. The National Green Thumb contest will be continued, but broadened beyond just food gardening. The educational service of the Institute, which has its headquarters at 598 Madison Avenue, New York 22, N. Y., will be expanded. A program to encourage gardening through the public schools and youth agencies will be initiated, and a service to the small home owner provided. Lloyd C. Stark, former governor of Missouri, has been reelected chairman of the board of the Institute, and Andrew S. Wing will continue as secretary-manager.

Hawk Slaughter

"Wanton Murder" is the title that the editor of *South Dakota Conservation Digest* puts over an editorial reporting "the appalling number of hawks that have been killed by hunters." These were seen on a trip around South Dakota. These hawks, he reports, "were ruthlessly murdered by pheasant hunters," and he adds that he could not call these hunters sportsmen. The editor made it a point to count and identify the hawks, finding every one of them "good" hawks, most of them rough-legs, perhaps the most beneficial of the birds of prey. Two were marsh hawks, and both of these species are protected by law in South Dakota. Says the editor:

"To the well-trained game expert, and to the well informed farmer, a hawk is one of the finest and most interesting forms of bird life. As a check upon harmful rodents and a controlling factor in keeping the balance of nature, a hawk is indeed a most valuable bird."

Yosemite Nature

Reptiles and Amphibians of Yosemite National Park. By M. V. Walker. Yosemite Park, California. 1946. Yosemite Natural History Association. 48 pages. Illustrated. Twenty-five cents.

The January, 1946, issue of *Yosemite Nature Notes* becomes a special issue devoted to the reptiles and amphibians of this Park. The treatment of the species is popular, and this booklet will be of permanent value and interest to visitors to Yosemite.

Manitoba Game Animals

Game Birds and Animals of Manitoba. Winnipeg, Manitoba, Canada. 1945. Department of Mines and Natural Resources. 48 pages. Illustrated in color by Allan Brooks and A. H. Shortt, and black and white by Clarence Tillenius. Twenty-five cents.

This little booklet is designed to be of particular interest to the gunner, but its pictures and descriptions make it equally of interest to those whose concern is for the animals themselves. Twenty-nine bird and seven animal species are discussed.

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OIL—THE POWER OF MODERN MAN

(Continued from page 131)

billion barrels.

The United States has something in excess of 39 percent of the world's proven reserves. The known reserves of other countries are estimated at 31 billion barrels, most of this lying in the Near/Mid-East, the Caribbean area, South America, the land of Soviet Russia (in and near the Ural Mountains), interior Europe, and the Far East. There was recently discovered a promising field in China, and pools are also known to exist in Alaska and in Canada. There are some petroleum reserves in Mexico.

Since the people of the United States are the most prodigious consumers of petroleum and its products, it is most obvious that we must turn more and more to the fields of other continents for our supply. We are now drawing from the Caribbean fields. Not so many years will pass before we may also have to draw upon the virtually undeveloped fields of the Middle East, where only a few wells have disclosed reserves that may prove to be even greater than our own.

Until World War II the petroleum industry had been highly competitive and individualistic. There was little thought of cooperation. Oil men were accustomed to serve as many customers as they could get. Then the moment arrived in 1941 when it appeared that individual enterprise might fall short of such an emergency goal as supplying the armed forces as well as the customers at home with vital petroleum products. So the late President Franklin D. Roosevelt directed that there be organized what was to become the Petroleum Administration for War.

The agency, born of emergency, was charged with the responsibility of coordinating the gigantic facilities of the petroleum industry so that all essential requirements could be met. Experts were drafted from the industry itself, and one of their first duties was to alleviate the shortage of petroleum products along the eastern seaboard. Mile-long express-trains of tank cars moved east from Texas, and construction of pipelines was launched. By the first of 1945 there were more than 140,000 miles of pipelines within the United States. It required a constant "fill" of 35 million barrels of oil and products to keep these lines in operation. This total figure sometimes confused the public because it showed up as "stock on hand." While this technically was true, it was not stock that could be called upon for emergency use, because, without the 35 million barrel fill, the pipelines could not function.

The largest of all the pipelines in the United States is the "Big Inch," which was sponsored by the Petroleum Administration. Two feet in diameter, the Big Inch originated in Longview, Texas, on the edge of the East Texas oil field and terminated 1254 miles away at Phoenixville, Pennsylvania, from which it fed crude oil to refineries in New York and Philadelphia. The longest pipeline in the country is the "Little Big Inch," 1475 miles long and 20 inches in diameter. It is a products line, carrying gasolines and other products from Texas and Louisiana refineries to New York outlets. The "Big Inch" cost $78,500,000, while the "Little Big Inch" cost $66,500,000 to construct.

The most important step in all this process of getting usable crude to the ultimate consumer—whether civilian or fighter—was refining. To the consumer, the refiner is a glamorous individual—although within the industry there is not a step anywhere from the oil well to the corner filling station that is not fascinating beyond comparison.

For half a century the oil man had satisfied himself by pushing the sales of his four principal products: kerosene (or coal oil), lubricants, gasoline and fuel oil. Then, some 30 years ago, it occurred to the oil man that the molecules in petroleum could be arranged into a multitude of new products. The scientist entered the picture. He found many ways to juggle the molecules, until the industry's 400 refineries—as of 1945—could produce products that heat homes, power ships, abolish the knock in automobile motors, furnish the backbone of plastics, and do many other things.

By 1939 the industry's chemists had their shelves lined with achievements that remained in the test-tube stage because of the prohibitive costs of their manufacture. Among these test-tube triumphs was jellied gasoline, which was regarded highly as a safety fluid because it would not explode as readily as other kinds of gasoline. There was also a fine diesel oil for tractor use. In addition, there was a lubricant that defied temperature.

When World War II began, the Nazi leaders, whose scientists had also made great progress, depended upon petroleum for the lightning thrusts that made them momentary masters in Europe. When the United Nations recovered from their dismay, they began equipping themselves to overcome the Germans. They were able to do it quicker and better because Americans by then knew how to go about it.

Americans knew, for instance, that their 100-octane gasoline gave extraordinary flying and carrying power in an airplane engine built to make full use of its properties. Because the Allies were manufacturing many planes, they needed tremendous quantities of 100-octane gasoline to power them.

Ralph K. Davies, Deputy Administrator of the Petroleum Administration and a top-flight oil executive, found one of his first tasks was to boost the production of 100-octane from 42,000 barrels a day (the United Nations' production as of 1941) to at least 100,000 barrels a day *immediately*.

Overcoming a multitude of obstacles, he did so—until production of that precious fuel reached more than 500,000 barrels a day in 1944. The cost per gallon, incidentally, fell from $30 to 14 cents.

Meanwhile, the original "perfect" 100-octane fuel was improved so often from 1941 to 1945 that it is almost necessary to describe the aviation gasoline with which the United Nations ended the war as being the "perfected perfect-perfect-perfect" aviation fuel.

Progress was also made in the uses of other fuels. The safety gasoline became the jellied petroleum that burned Japanese out of their Iwo Jima island caves. The lubricant that defied temperature was most useful for the airplanes that took off from the torrid sands of the Sahara and soared into the sub-zero weather of the near-stratosphere.

Whenever the armed forces needed a new type of petroleum product, they brought their specifications to PAW. Sometimes it was necessary only for the chemists to reach up on the shelf and bring down another test-tube formula, and, by V-J Day, the United States was furnishing more than 75 percent of all the oil products needed throughout the United Nations to conquer the enemy. And the petroleum industry was set to meet demands that ran into even more astronomical figures.

Now, from the standpoint of people like you and me, what good, in peace, are we going to get out of the petroleum miracles of war? Believe it or not, no genuinely *new* petroleum product has come out of this war. The real, constructive, exhilarating development coming out of warfare was that it enabled the chemists to take their triumphs off the shelves and put them into actual use. In the mass production required in war, the costs of manufacture sank from the prohibitive to the range of the man-of-the-street's pocketbook.

From now on you will buy better gasoline for your automobile, or for the little one-lunger that runs your farm pump. You will buy better home fuel. It may even be cheaper. The tiresome warnings of the radio announcer to change your oil to winter grade, or spring grade, or what-have-you, may become obsolete. There will be on the market a multitude of war-tested, more economical and better performing products.

In the world of plastics, the progress has been equally encouraging. At the beginning of World War II, the scientist knew a vast amount about plastics. From certain portions of crude oil, there came such things as alcohol, formaldehyde and similar products. All of these furnished the background of such products as inks,

paints, synthetic rubbers, lacquers, anti-freezes, fats, drug solvents, chewing gums, bakery products, cosmetics, soaps and textiles.

The future of the plastic industry is promising beyond practical prediction. Today the seasoned oil man, no matter how advanced he may be, looks upon plastics as the Thing of Tomorrow—with some reservations. Houses and automobiles can be made from plastics with petroleum bases, but a well-hurled rock could literally break up a home, and a bit of fender-scraping could reduce an automobile to a shovelful of trash.

Great progress has been made in the synthetic rubber field. Butal rubber for inner tubes has proven to be impervious to "slow leaks," so that you can fill up your tires and ride on them until you have a blow-out. Buna rubber, on the other hand, is—as paradoxical as it may seem—stubbornly oil resistant. But neither one will stand up to heat.

But the American people, their government, their scientists and their industries have an extraordinary way of overcoming these imperfections. The petroleum people are anxious to help. Who knows, you may be sleeping on an oil mattress tomorrow, and cleaning your teeth with oil, and sugaring your cornflakes with it. The possibilities are there. You need only to have the price brought down.

This development has come a long way from the days when the Indians skimmed atouronton from the streams of the Ohio River Valley.

Nature furnished these tremendously rich petroleum reservoirs, and mankind, by his scientific advancement, has turned the decayed remains of millions of years ago into uses that have been both good and evil. World War II was fought because of political ideologies, but, if there should be another war, it may be fought for the possession of the oil reservoirs themselves. The modern man certainly is not insensible to the fact that oil is probably one of the most prized of all of Nature's resources.

Modern man does not utter "*Atouronton*" in the sense that it means "Oh, how much there is of it." Rather, he murmurs, in prayer, "Let us hope that it never runs out."

Trail Walkers

We note with pleasure that that indefatigable hiker, Ernest A. Dench of Ho-Ho-Kus, New Jersey, is continually expanding the membership and the activities of his Woodland Trail Walkers. His late winter and spring schedule is as varied as ever, and, as we have remarked before, any hiker who lives in this region of North Jersey or in not-too-far-distant areas is missing a bet in not walking with these walkers.

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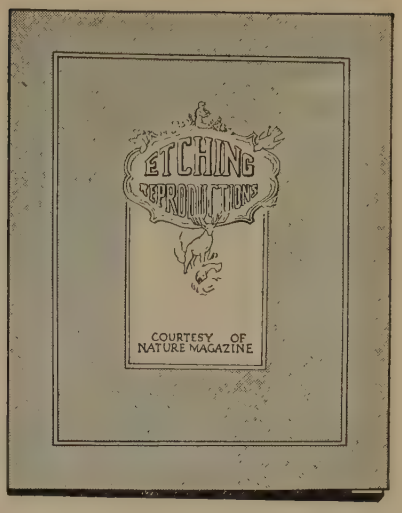

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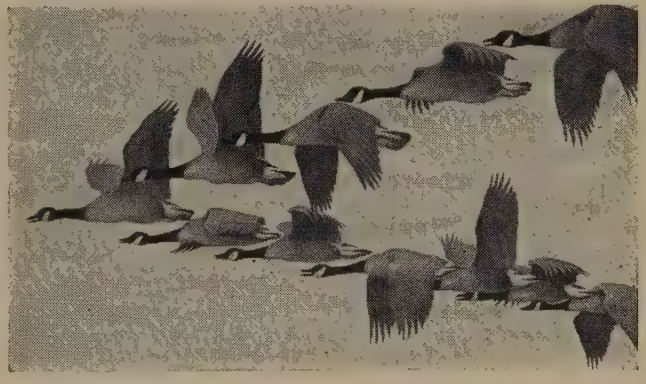

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Robins Again

(We have reported before some of the reactions of our readers to the comments on the robin by George R. Hopkins in our November, 1945, issue. We had intended to let the matter rest there, but then we received the following letter from Denver, Colorado. Besides taking up the cudgels for the robin, this letter is a delightful word from a lover of Nature. It is too good merely for the oblivion of our files. Editor.)

Editor, Nature Magazine:

I cannot agree with George R. Hopkins, who writes in your November issue that he considers that the robin is a nuisance and a fake—in short, an avian washout. Surely the charge that he is undesirable because he destroys earthworms, which are admittedly beneficial to the soil, is less impressive when we consider the great numbers of these worms which are destroyed when the heavy rains drive them out of the ground, where they wither on city pavements and surfaced roads. Yet it has never been suggested that worms may be seriously reduced by reason of this natural force, which is entirely beyond man's control. Why, then, single out the robin simply because he is a tangible offender, subject, as all living things are, to the will and judgments of men? Then, too, man himself is an enemy of the earthworm, and only that individual who has never baited a hook with a delectable worm in order to snare one of the finny tribe has any legitimate right to cast any accusations against a feathered offender on this count.

The damage that robins cause to fruit crops is a more serious charge and one that cannot be ignored or argued against as of little consequence. Here again, however, there are other forces equally active against the fruitgrower, and it is not fair to hold the robin up as the worst offender. Admitting that the robin does damage certain crops, it is nevertheless written that man shall not live by bread alone, and in the realm of the esthetic and spiritual I would place the robin ahead of any of the other birds native to this continent.

Not that I would always have rated him thus. On the ranch high in the Rocky Mountains where I was privileged to spend most of my time as a child, while I was always thrilled on the first day in March when a sharp note from the neighboring hillside announced the arrival of the first robin, my attention was soon thereafter distracted by the flash of the heavenly azure blue of the mountain bluebird, the mysterious, tingling night cry of the saw-whet owl, the first arresting WHAT CHEER of the olive-sided flycatcher, the plaintive song of the white-crowned sparrow from the underbrush along the river, and, above all, the ethereal hymnals of the hermit thrushes at evening, echoing across the canyons in mid-May. And of all the various bird personalities with which the Rocky Mountains abound, the robin assumed only an ordinary place.

But I was to learn in later life that these glamorous bird voices, like the prima donnas of their human counterparts, could be heard only at their own time and on a stage of their own choosing, and the person who could not transport himself to such a setting is barred from the enjoyment of their music and presence. When from one year to another I was confined to a very few square miles within a heavily populated city, where the species I had loved so as a child paused only long enough to awaken the pain of memories of a world that now lay beyond my grasp, then it was that the robin came into his own. As if conscious that here he must make up for the absence of his more elusive kin, in the cities he exhibits many endearing traits never betrayed when he is seen against a background of somber and majestic mountains. There he is shy and retiring, except when protecting his nest, and he races away through the forest like a diminutive pheasant. But here in the suburbs he follows almost at your heels catching insects disturbed in the mowing or raking of a lawn, while the little females run before you, snatching up dead grasses for their nests as they go, and just keeping the tips of their tails a foot or two ahead of your advancing steps. Any invalid who can look out upon a lawn or even into an alley may see this feathered neighbor going about his business; though one may be unable to take a step out of doors, the robin will come to the house itself and build his nest on the roof drain or the porch pillar; whoever can listen through an open window can hear the evening performance of his homely choir. Other bird voices may be more beautiful, just as the specially trained human voice may thrill us in the concert hall, but who among us would exchange the kindly words of familiar friends, the off-key ditty of a childish voice, and the Sunday hymns from the church across the street, for a single scintillating song recital at the municipal opera house?

Yes, the other birds thrill me yet—the brief performance of a Nuttall's sparrow wafted through my open window one Sunday morning from a vacant lot where a single bird, thwarted by a late spring snow storm from reaching his chosen home in an Alpine meadow, was thus whiling the time away during his enforced sojourn in these dull surroundings, prompted me to listen at that hour for days afterwards in the hope that he or another of his kin would spare me a little more of the divine music which they pour out so freely in the majestic wilderness where too often there is no human ear to listen or heart to be inspired. And the memory of the heavenly vespers of several hermit thrushes, answering one another from the spires of the last sentinels of the timberline on one of the few automobile passes through the Continental Divide, to which my brother and I sat and listened, for the last time together, just before he went away into the war from which he never returned, assures me still of a time and place where hope is not mocked and the dream and its dreamer do not fade. But I recollect also that there was mingled with these voices another note, less ethereal, perhaps, but full of reassurance and confidence that this present life is worth while and that goodness and beauty are still to be found in this world, and it came from a single robin, whose mate was probably brooding her eggs in a dwarfed pine beneath the shadow of the near-by overhanging cliffs as contentedly as her city cousin at that same time was feeding her young, now strengthening their wings in a sumac bush overhanging my porch at home where the season was fully a month advanced over that in the rarified atmosphere at the tree line. It was as if he were reminding me that, although he might be such a commonplace sight around men's dwelling places, that scant attention is ever paid to him, actually he is as much at home in the more inaccessible and romantic regions of our country as his secretive and less mundane cousins, the thrushes, are, from whom he differs only in that he chooses to diffuse his gifts among a greater number of people, many of whom can never attain the exalted heights where those divine singers hold forth.

There are millions who will never listen to the midnight raptures of the nightingale or gaze heavenward while the notes of the skylark shimmer down from the blue, and can imagine the nature of this beauty only through the works of the great poets and musicians whom it has inspired; but they are assured that so long as the seasons come round to our northern hemisphere the robin will return to every habitation, however lowly and obscure, with his annual message of hope and cheer and good will. Like many another of those common but unromantic elements which, taken together year in and year out, contribute the most to our happiness and well-being, the robin has never been immortalized by any of the great poets, who have chosen to tune their lyres in praise of more romantic subjects. But if a counterpart of Robert Burns, poet of the common man, shall ever arise and he has occasion to know the American robin, I am sure it will be one of the first subjects to be treated by his pen. Of it, as truly as of the people of whom Burns was thinking when he wrote them, these lines are applicable:

"What though on hamely fare we dine—
Wear hoddin' gray and all a'that?"

No, the robin does not dine upon honeysuckle nectar and orchid pollen—he takes whatever Nature provides in the way of sustenance, and if an earthworm is all that is forthcoming he takes it gladly and is as apt as not to warble a few notes of thanksgiving immediately thereafter. Neither of him can it be said that he is like a winged flower among the trees, or that he carries the glory of the sky on his back. But it can be said of him, as of no other American bird, that he carries the earth on his breast and its people in his heart as well, else why does he distribute himself so completely over every square mile of North America where he can find a living of any kind? With us, he lingers in the fall until the worst blasts of December drive him a few hundred miles farther south, and he is back in February, with the bitter winds and below-zero weather of March yet to follow, as though he would not leave us comfortless and alone for any longer time than is absolutely necessary. He is the laboring man's own bird, and for him he stages his most inspired performances when the first rays of dawn are breaking in the east—not for the luxury lover and the midnight reveler does he sing—by the time they are rousing themselves into consciousness the sun is high in the sky and he has long since settled down to his daily routine. He is indeed the friend, inspiration, and example of the masses, and it is in recognition of my own indebtedness to him that I write this word of praise. If it should inspire a more gifted pen than mine to write for him a truly fitting tribute, it shall have served a double purpose.

CATHERINE A. HURLBUTT.

HOW FAST DO BIRDS FLY?

(Continued from page 152)

estimated speed of the aviator's duck hawk mentioned in Lawson's account—360 miles per hour.

If it is allowed that the golden eagle and the duck hawk hold the speed records among birds for any type of flight, including, as in their case, gravity-aided flying, what bird holds the record for horizontal flight, or what we may call true flight? As far as my researches go, and I have devoted considerable time to the investigation of such records, the two fastest birds in horizontal flight are the Indian spine-tailed swift and the frigate-bird.

In India, the famous authority on Indian bird life, the late F. C. Stuart-Baker, repeatedly timed spine-tailed swifts over a carefully measured two-mile course, which the birds often covered. The stop-watch readings varied between 32.8 and 41.8 seconds. The speeds for the course, therefore, varied between 219 and 174 miles per hour. ("Country Life," March 13, 1942.) It is true that the wind and other factors are not given, but as the timings were made repeatedly it is unlikely that these factors would materially alter the figures given. In any case it would require little short of a tornado to carry a bird along, without any effort of its own, at the speeds given by Stuart-Baker.

The fastest horizontal flight speed of which there is authentic evidence has been recorded for the frigate-bird. The evidence is in a letter that Commander J. E. Capstickdale, R. A. N. R., sent me in 1941. He has kindly given me permission to quote the letter.

Commander Capstickdale observed a flight of frigate-birds pass over his schooner. The birds were flying towards an island. The time, by chronometer reading, was observed. Later the Commander compared notes with a man on the island, who also had observed the same flight of frigate-birds and had also taken the time by ship's chronometer. In his letter the Commander gives details of the checks that were made, and of the allowance for windage. The resulting speed, in level flight, worked out at 261.4 miles per hour.

But a correspondent to a certain paper capped these, and all other Nature speed records, when he maintained that the cave swallow of Ceylon flies so fast that, unlike Victorian children, it can be heard but not seen!

SPEED TABLE

(All records, except last two, timed by aeroplane speedometer)

Bird	*Speed (m.p.h.)*	*Remarks*
Gannet	48	
Lapwing	50	
Snow goose.....	50	Bird chased
Swan	55	
Canada goose....	60	Bird chased
Mallard (wild duck)	65	For ten miles
Pintail duck.....	65	
Teal	68	Bird chased
Brant goose.....	70	
Canvasback duck.	72	Bird chased
Golden eagle	90	Faster when nose-diving
American cloud swift	95	Bird circled round plane traveling 85 m.p.h.
Lammergeier, or great bearded vulture	110	Bird nose-diving
Sandpiper	110	Flock migrating
Black vulture ...	130	Timed on two occasions
Indian spine-tailed swift	219	
Frigate-bird	261	

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Under the Microscope

By JULIAN D. CORRINGTON

THE PHOTOMICROGRAPHS FROM SLIDES COURTESY OF WARD'S NATURAL SCIENCE ESTABLISHMENT

MONOCOT STEMS

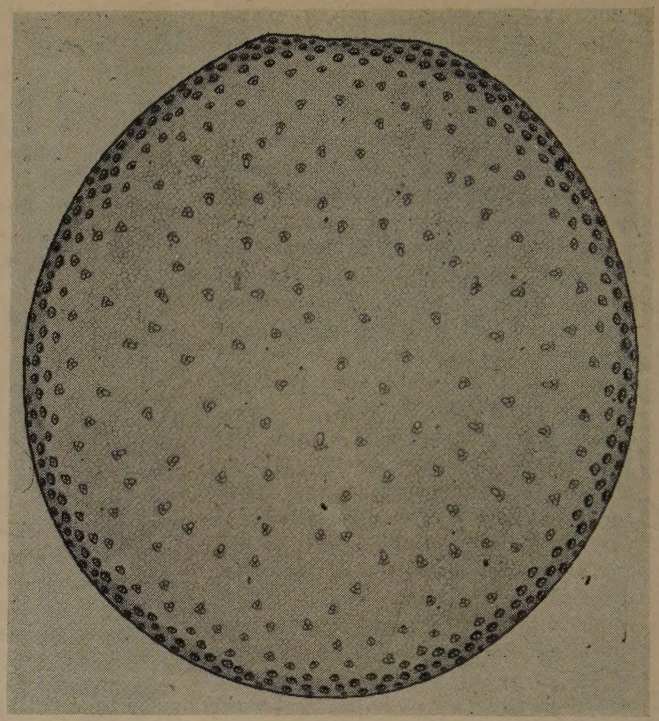
THE architecture of plant stems is a fascinating topic in botany, and is studied mainly from cross sections, with occasional aid from slices in other planes. Of the several types of stem, that of the monocot, such as corn, is one of the simpler, and makes a good starting point. The term "monocot" is a commonly used abbreviation for monocotyledon, a representative of a class of flowering plants (Monocotyledoneae) in which there is but a single cotyledon, or seed leaf, and in which the leaves have parallel veins and the flower parts are in threes or multiples of three. Some common monocots are the grains, as wheat, oats, barley, rye, rice, corn; the grasses, rushes, and sedges, sugar cane, bamboo; the palms, yuccas, aloes, lilies, irises, hyacinths, onions, asparagus, pineapples, bananas and, largest of all monocot families, with more than 9000 species, the orchids.

The other great class of the Angiosperms or flowering plants is the Dicotyledoneae, or dicots, with two seed leaves, net-veined leaves, and floral parts in fours, fives, or their multiples. Examples include our hardwood trees, as maples, oaks, elms, fruit trees as apples and peaches, and the majority of flowering shrubs, vines, and plants, as sunflower, poinsettia, ragweed.

Because considered "typical" for the entire class, or through availability, ease of processing, or merely by custom, certain monocots have become standard in the study of various plants or processes. Thus, the onion root-tip for mitosis, corn for the stem, iris for leaf, lily for flower, and corn again for the seed.

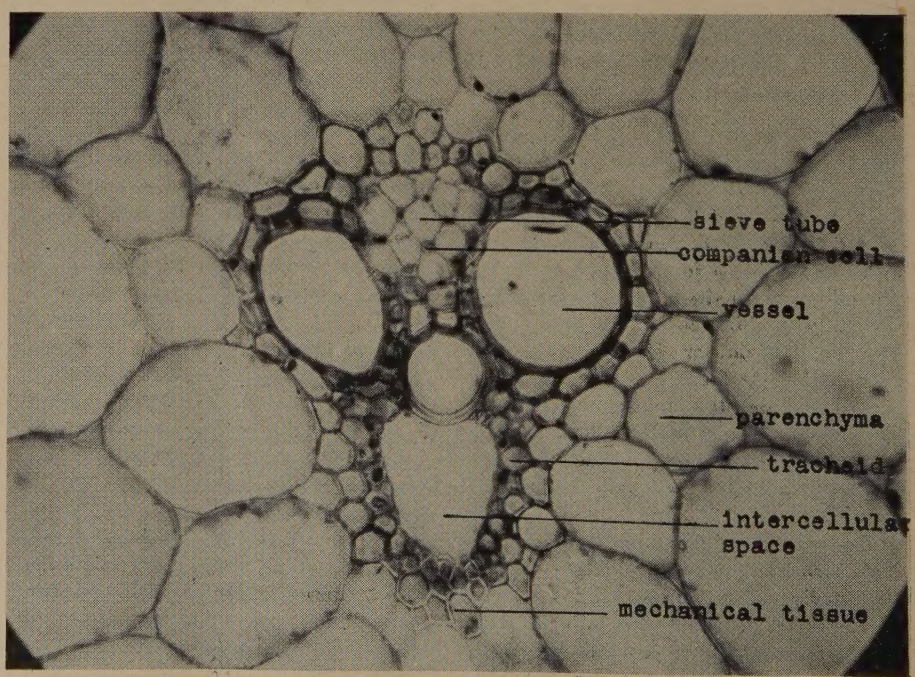
The corn stem presents nodes, where leaves arise, and internodes between such joints. A section through an internode, as in one of our illustrations, shows an outer layer of cells, the epidermis, followed by a narrow ring of mechanical tissue, the hypodermis, which, with the epidermis, constitutes the hard rind that gives the stem much of its strength. This zone is roughly comparable to the cortex or bark of a dicot stem, but is not separated by any line of demarcation. The large, thin-walled cells making up the bulk of the interior of the corn stem comprise the parenchyma, comparable with the pith of a dicot. Scattered throughout the parenchyma are vascular bundles, one of which is shown in our illustration under high power. Vascular indicates the presence of transporting vessels, analogous to the blood vessels of animals.

A single bundle has an outer ring of mechanical tissue or sclerenchyma, so called because the cell walls are thickened and hard, to serve as skeletal support. This ring is thickest at the inner and outer margins of the bundle and thinnest along the two sides; within the ring, all cells are differentiated into phloem in the outer portion, xylem in the inner region. As these terms are of the highest importance for an understanding of stem construction and functioning, some discussion of them becomes necessary, at the risk of boring those readers who have studied biology.



Cross section of corn stem, 14X.

The phloem (pronounced flow-em), from a Greek word for bark, is that part of a vascular bundle that contains sieve tubes, their companion cells, and adjacent parenchyma, and serves to conduct food downward from the leaves to stem and roots. The sieve tubes are elongated cells, arranged end-to-end. As each cell matures it dies, the nucleus disintegrating, and the interior coming to contain a large vacuole or space. Thus these cells become hollow tubes. Across the end walls between two successive cells is a sieve plate, a membrane with a number of relatively large openings. The construction may roughly be imagined by thinking of a number of soda straws, aligned end-to-end, with a layer of tissue paper between each straw, the paper pricked with a quantity of needle holes. This establishes a conduit, not as freely open as connected pipes in a water main, but nevertheless facilitating the ready transfer of



Detail of one vascular bundle, corn stem, 500X.

materials. The companion cells are slender and elongate living cells that lie alongside each sieve cell.

The xlyem (pronounced zí-lem and meaning wood) makes up the wood of tree and other woody stems and consists of several kinds of elongated structures. Tracheids are narrow, lengthened cells, pointed at each end, whereas vessels result from a longitudinal row of cells that enlarge greatly in width during development and lose the intervening cell walls so that a continuous tube is formed—like the description for phloem tubes except that there are no sieve plates. Both tracheids and vessels exhibit a heavy deposit of wood in their walls and are dead structures when mature. Their function is to transport water upward from the roots. Tracheids may have the last layers of woody material deposited as a spiral thickening that runs the whole length of the cell, or this material may form separate rings. Vessels may have spiral or annular thickenings, or the last deposited material may be deficient in circular areas, leaving round spots with thinner walls and giving rise to the type termed pitted vessels. In the corn stem there are two large vessels with pitted walls at each side of the center of each vascular bundle; these form the "eyes" of the "monkey-face" pattern exhibited by most bundles. Below these occurs one, sometimes two, smaller vessels with spiral or ringed thickenings, making the "nose." Just below and bordering this is an intercellular space, the "mouth," separating the xylem from the ring of sclerenchyma. Alongside the vessels are a number of tracheids.

In dicots, differentiated phloem and xylem strands mature from columns of embryonic, undifferentiated cells known as meristem. These cells have the potentiality of becoming any of several kinds of adult cells, as vessel, tracheid, sieve, companion, or the rather undifferentiated parenchyma cells. In this group, moreover, there always remains a thin strip of meristematic cells, the cambium, and from this layer secondary growth occurs each season, with the formation of secondary phloem on the outer face of the ring of cambium and secondary xylem on its inner face. Thus the stem increases in diameter from year to year and shows annual rings of wood in the xylem as well as the less distinctly visible annual increments to the phloem, Thus also, since the vascular bundles form in a ring, and not scattered as in monocots, the bark may be peeled off from the wood, the line of separation being at the cambium. You cannot strip off any bark in a monocot; there is no such line of separation.

The most striking of microscopic differences between dicots and monocots lies in the fact that in the majority of the latter all of the procambium, as the early strands of meristematic tissue are termed, transforms into primary phloem and xylem; no undifferentiated cambium remains and so there is no possibility of further growth in girth. A slender bamboo stem does not grow into a thick one; different diameters in pieces of bamboo stem represent different individuals or species. The vascular bundles of monocots are called closed bundles, as they are "closed" to further growth; those of dicots are open bundles.

Summing up the differences between what may be thought of as a typical monocot and a typical dicot stem, the monocot has its vascular bundles scattered instead of arranged in a circle, sclerenchyma encircles each bundle, no rays run in radiating fashion for the lateral distribution of food and water, there is no cambium, and no well-defined cortex or pith.

In some monocots, as grasses, mature stems are hollow; in others solid, as in corn. A few monocots, as the coconut palm, have a tapering trunk which comes about in a peculiar manner. There is no cambium to form new cells, but cells already present have a delayed enlargement, from the apex toward the base, causing a growth in diameter very different in character from that of a dicot tree. In the Joshua tree of our Southwest, the aloe, and the dragon tree, there are certain cells that become meristematic from time to time and produce new parenchyma and vascular bundles, causing a slow growth in stem diameter.

Later articles in this series will describe the stems of dicots and of gymnosperms—the flowerless seed plants, as pine—as well as the various techniques for sectioning and staining stem sections.

ADDENDA: MOUNTANTS

Just too late for inclusion in our article on "Resinous Mounting Media" in the January number, we learned of another synthetic product that should be included in the listing given. This is Harleco Synthetic Resin, developed to replace certain others that were not available during the war. The color of this mountant is very pale, almost water-white, it is chemically inert and neutral for all practical purposes, is non-yellowing, has a high melting point and a refractive index of 1.54. It is available as a dried resin, as a 60% solution in toluene, or as a 40% solution in xylene, and is sold in 1 oz., 4 oz., 8 oz. or 16 oz. packages. Two sources known to us at present include the manufacturers, the Hartman-Leddon Co., 6010 Haverford Ave., Philadelphia 31, and the Chicago Apparatus Co., 1735-1743 N. Ashland Ave., Chicago.

BEGINNER'S PRIMER

One of the lowest families of the Diptera, or flies, and a good one with which to begin our survey, is the Mycetophilidae, the fungus gnats or mushroom flies.

Background for the Microscope

Equipment for the pursuit of microscopy may be as simple or as elaborate as individual inclinations dictate; but there is one item wholly indispensable —*books!* The microscope is handmaiden to all the sciences, and those who follow its adventuresome trail must have many a guide to direct along the right path.

Here is NATURE MAGAZINE'S selection of best bets. Check your library and add those that fail to answer the roll call. Buy one each month, or as often as you can. Suggest them as gifts. Buy them for the relative or friend whose chief joy is working with his microscope. Entries will be changed periodically; here is a basic list for a starter:—

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These insects are of medium to small size, and comprise some 2000 known species, many of which occur in enormous numbers, world-wide in distribution. They are to be looked for in and on fungus growths of many types, as mushrooms, in decaying wood, and other damp places where there is decomposing vegetable material.

A typical adult somewhat resembles a mosquito as to size, shape, length of legs and appearance of wings. On close inspection, fungus gnats may at once be identified by having the coxa, or first segment of the leg, greatly enlarged and elongated, and with spurs on the tibiae, the fourth leg segment. There are no whorls of hairs on the antennae, as in mosquitoes; instead, the antennae are long and filiform, with from 12 to 17 segments, mostly 16, the two basal segments enlarged. The thorax is arched, giving the body a humpbacked aspect. Color varies through yellow and brown to red and black. The maggots are long and slender, whitish in color, occasionally brown or black, cylindrical, smooth, soft, with the head strongly chitinized, mandibles and maxillae present, antennae short or vestigial.

Comstock relates that the larvae of some species of *Sciara* often assemble in great numbers, sticking together in dense patches. They may be found under the bark of trees or on the march, when they are generally termed a "Sciara-army-worm." Such excursions may include so many larvae as to make a serpent-like body four or five inches wide, ten or twelve feet long, and four to six larvae deep. They crawl over one another so that the whole "army-worm" advances at the rate of about one inch a minute.

Tillyard describes a remarkable New Zealand species, *Arachnocampa luminosa,* which is luminous in the larval and adult female stages, and is locally termed "glowworm." There is a famous Glowworm Cave at Waitomo where the visitor is taken into the dark cavern by boat, and marvels at the thousands of tiny lights covering the walls. He calls this one of the outstanding wonders of the world. Some species of fungus gnats spin webs for capturing prey.

It is difficult to find a mature fungus in our fields and woods that is not infested by these tiny flies, and they frequently invade mushroom cellars and destroy these commercially cultivated plants. Some species of *Sciara* may attack house plants and do damage in greenhouses. Incidentally, the larvae of this genus have been used in cytology, in making smears of the giant salivary gland chromosomes.

In collecting, break open any old or brownish mushroom, toadstool, bracket fungus, puffball, or other fungus. Usually a single specimen will yield copious material. The adults leap like a flea, with their elongated legs, as well as take wing to escape. Both adults and larvae make attractive whole mounts, an item usually overlooked by most microscopists.

HISTORICAL OUTLINE

Of the Big Three of the golden age of bacteriology, the last to be discussed is Sir Joseph Lister, father of modern surgery and Britain's contribution to the new science. His father was eminent in optics, perfecting achromatic lenses and improving the compound microscope. Born at Upton, Essex, Joseph graduated from University College, London, and went then to Edinburgh, in 1853, to become house surgeon to Syme. Three years later we read of a most tangible form of his success in that he married Syme's daughter, and was made assistant surgeon to the Royal Infirmary. There he delivered his first course of lectures on surgery and began the studies that were to give him fame.

While a student in London, Lister became interested in work on the blood, particularly its coagulation and such infections as pyemia and gangrene. Puerperal or childbed fever killed many women, and any break in the skin in those days was liable to result in suppuration, usually with fever, and often fatal. Such infections were known under the vague term of "blood poisoning." Dr. Oliver Wendell Holmes of Boston in 1843, and Ignaz Semmelweis of Vienna a bit later, were convinced that puerperal fever was carried to the delivery room on the hands of the very persons whose task it was to save both mother and child—the doctors. They urged scrubbing of the hands! "Ridiculous!" snorted other doctors; yet the death rate in their hospitals fell remarkably and the scoffers were forced into line. And this was only 102 years ago.

The two leading theories for blood infection then current were, first, that of the chemist, Liebig, who blamed it on oxygen in the air and said that therefore nothing could be done about it, and, second, that germs were spontaneously generated in the wound. In 1857 Lister published a classic paper on "The Early Stages of Inflammation," and in 1863 delivered the Croonian lecture before the Royal Society on coagulation of the blood. Meanwhile, in 1860, the rising scientist had been appointed to the chair of surgery at Glasgow, continuing his studies on inflammation, and discovering that he could detect putrefaction (sepsis) in suppurating wounds by the odor. He suspected that decomposition of the blood in a wound was responsible, and when, in 1865, the work of Pasteur was brought to his attention, he at once saw a chance to apply the new knowledge of bacteriology and its attendant overthrow of the old belief in spontaneous generation to his own researches.

Lister heard also that carbolic acid (phenol) had been used to deodorize sewage, and now reading that Pasteur had shown putrefaction due to air-borne bacteria, he decided to concentrate on the use of chemicals to overcome sepsis.

In 1865 he made his first experiment, using undiluted carbolic acid on a compound fracture. This powerful caustic formed a thick crust with the blood, and this he painted daily with the carbolic until all danger had passed. After an initial failure his further trials were highly successful and his paper for the *Lancet* in 1867, "On a New Method of Treating Compound Fractures, Abscesses, etc.", created a sensation. He next searched for some inert medium with which to dilute the acid so as to afford a maximum of sterilization with a minimum of irritation.

Lister also turned part of his attention to the arrest of hemorrhages in aseptic wounds. The practice of the day was to tie off arteries with threads of silk or flax, leaving long ends for drainage. Lister reasoned that if the threads were made sterile, they could be cut off short and left in the wound or incision to be absorbed, the wound then healing by first intention. In 1867 he tried carbolized silk ligatures with success, but later sought a material that would be absorbed more completely and quickly, and found it in catgut. In 1869 Lister succeeded his father-in-law, Syme, in the chair of clinical surgery at Edinburgh, and there introduced his famous methods of spraying 1-20 solution of carbolic in water to create antiseptic conditions in the surgery, particularly in the atmosphere.

At the London Congress of 1881 Lister gave account of his experiments proving that the blood serum is an unfavorable medium for development of air-borne bacteria, and that cells in a blood clot have remarkable bactericidal properties. These studies and reports from other investigators led him to abandon spraying the air (antiseptic surgery) but to concentrate on complete sterility of the hands, person, clothing, instruments, and other surroundings of the patient (aseptic surgery). Steam-sterilization of dressings was introduced in Berlin in 1886 by von Bergmann, and Halsted, New York, 1890, began the use of rubber gloves. Hospitals now ceased being pest houses, and difficult operations were performed in safety.

In 1877 Lister accepted the chair of surgery at King's College, London, where he remained for 15 years. He retired from private practice in 1896, but kept up his studies. From 1895 to 1900 he was president of the Royal Society and, in 1896, of the British Association. Created a baronet in 1883, he was raised to the peerage as Baron Lister of Lyme Regis in 1897. In the Coronation Honors of 1902 Lord Lister was made an original member of the new Order of Merit. On the Continent he was even more celebrated than at home, and surgeons the world over adopted his methods. His most lasting monument is doubtless the Lister Institute of Preventive Medicine, in London, modeled after the Pasteur Institute of Paris. He died in 1912.